



Burt Market Masterplan, Bury

FLOOD RISK ASSESSMENT & DRAINAGE STRATEGY REPORT



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Bury Market Masterplan, Bury

Flood Risk Assessment & Drainage Strategy Report

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Bury Market Masterplan, Bury

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Vinci Construction UK - Bury Market Masterplan. Bury



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Alan Johnston Partnership Ltd.

Company No. 13204766

Bury Market Masterplan, Bury

Flood Risk Assessment & Drainage Strategy Report

1.0 INTRODUCTION

This Flood Risk Assessment (FRA) and Drainage Strategy Report has been prepared on behalf of VINCI Construction UK in connection with the construction of a flexi hall and new market canopy for the existing Bury market. The development is situated on the existing Bury market site, in the town centre of Bury and is located towards the north end of Market Street. Even though the site is located entirely within Flood Zone 1, the total area of the proposed development is over 1.0ha and therefore an FRA is required.

This FRA has been prepared in accordance with the general requirements of the National Planning Policy Framework and the associated Planning Practice Guidance, both published by the Department for Communities and Local Government. This involves the identification of flood risk to new development(s) on the site, the possible effect of this development on flood risk elsewhere and the investigation of the impact on the development as a result of increased sea levels, fluvial flows and larger pluvial events due to increased impermeable areas and climate change.

The purpose of this report is to present a site-specific assessment of flood risk based on available information, to identify relevant flood levels affecting the site with respect to a particular probability of flooding. The flood levels identified are dependent on the correctness of the current conditions, as stated in this report and the prediction of future climatic conditions implicit in the National Planning Policy Framework.

For any size of storm event, the procedure will always yield a probability that the event will occur in any year, albeit the probability is smaller for larger events. The predicted storm event has a probability of occurrence in any year and the derived flood level has an associated probability of exceedance. This means that there is always a risk that property flooding could occur one or more times in any year.

Therefore, this report should not be interpreted or relied upon as providing a guarantee against flooding. There is always a residual risk that flooding will occur and it is not possible to predict a zero risk of flooding.

In accordance with National Planning Policy Framework (NPPF) and the associated Planning Practice Guidance, flood risk must be assessed for all sources including tidal (from the sea), fluvial (from rivers), pluvial (from land), groundwater, sewer and artificial water bodies (e.g., reservoirs, canals, major water supply infrastructure etc.).

More specifically, the development of any site must be carried out in such a way as to mitigate any potential flood risk, both on and off site from all sources of flooding.

The other purpose of this report is to present the surface water and foul water outline drainage strategies for the site which have been developed by the Alan Johnston Partnership. To demonstrate how the specific drainage requirements are to be met, the report should be read in conjunction with the relevant drawings and supporting information, included within the appendices.

The drainage strategies outlined within this report, have been prepared in accordance with BS EN 752:2017 (Drain and sewer systems outside buildings), Sewers for Adoption, Building Regulations Approved Document H (Drainage and waste disposal), the National Planning Policy Framework document (Department for Communities and Local Government, July 2021) and associated Planning Practice Guidance.



2.0 SITE DESCRIPTION

The site is situated on the north end of Market Street (B6218) where the current Bury market is located and is at National Grid reference SD 80587 10538. The site location is illustrated in Appendix A and the extent of the area to which the application relates is shown on the enclosed aerial photo, attached in Appendix B.

The existing site covers a total area of 1.488ha and is entirely a brownfield site. The site comprises of the existing administrative and retail units as well as the existing bury market area. The site is bounded by the surrounding highways and other existing retail units.

The site is fairly flat with a slight fall from east to west. The levels fall from approximately 94.10mAOD in the east to around 93.70mAOD in the west. An aerial photo is included in Appendix B to illustrate the site at the present day and a topographic survey is attached in Appendix C.

2.1 Geology

The British Geological Survey (BGS) 1:50,000 Bedrock geology maps show that the site has superficial deposits comprising of glaciofluvial deposits, with the bedrock reported to be of the Pennine Lower Coal Measures Formation, comprising of mudstone, siltstone and sandstone.

This is supported by the site investigation completed in August 2022 by iD GeoEnvironmental Limited, Report No. 5237-G-R001 Rev A. The site investigation report indicates that the underlying strata consists of made ground down to a maximum recorded depth of 2.5mbgl which is underlain by glaciofluvial superficial deposits comprising of sands, gravels and clays, down to a maximum recorded depth of 14.5mbgl. The mudstone bedrock was also proven at a depth of around 14.1mbgl.

2.2 Hydrogeology

The Environment Agency groundwater maps show that both the superficial deposits and the bedrock are classified as Secondary A Aquifers, defined as permeable layers that can support local water supplies, and may form an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

The Environment Agency groundwater maps also indicate that the development site is not situated within a groundwater Source Protection Zone (SPZ).

The iD GeoEnvironmental Limited, Geoenvironmental Appraisal Report indicates that groundwater strikes were recorded as shallow as 2.51mbgl, however as these are recorded within the made ground it is envisaged that these are areas of perched water, with the actual groundwater level found at levels around 6.29mbgl.

2.3 Hydrology

The site is located within Flood Zone 1 which is categorized by the Environment Agency as land assessed as having less than a 1 in 1,000 annual probability of river flooding (1% - 0.1%). Therefore, the site is an area identified by the Environment Agency as at low risk of flooding from rivers and streams.

3.0 PROPOSED DEVELOPMENT

The entire site covers a total area of 1.488ha, however there are some areas of the site to remain as per the existing scenario. The total area of the site to remain as per the existing scenario is 0.085ha, therefore only the remaining 1.403ha area will be considered within the remainder of this report.

The proposed development is to demolish the existing administrative building and retail units to the west of the site and replace them with a new flexi-hall building and surrounding pedestrian areas. The development will also include two new green roof canopies, above the existing open roof market areas to the east of the site.

To enable a viable scheme, the proposed site levels are constrained by the existing retail units, the bus station and highway surrounding the south of site, therefore the site levels may be amended but are likely to remain similar to the existing in order to tie into the surrounding developments and highway. A proposed site plan is attached in Appendix D.

4.0 PLANNING POLICY

The National Planning Policy Framework (NPPF) sets out the Government's policy on meeting the challenges of climate change, flooding and coastal change. The NPPF states that:

“Planning plays a key role in helping shape places to secure radical reductions in greenhouse gas emissions, minimising vulnerability and providing resilience to the impact of climate change, and supporting the delivery of renewable and low carbon energy and associated infrastructure. This is central to the economic, social and environmental dimensions of sustainable development. Local planning authorities should adopt proactive strategies to mitigate and adapt to climate change taking full account of flood risk, coastal change and water supply and demand consideration.”

This Flood Risk Assessment proposes recommendations to facilitate the proposed development so that it takes into account flood risk at all stages of the development.

4.1 Sequential and Exception Test

Based on the sites location in Flood Zone 1, the development is deemed appropriate according to NPPF therefore the development is appropriately situated and the Sequential Test is not required.

4.2 Exception Test

NPPF classifies the development (shops) as a ‘Less Vulnerable’ development and as the site is located within Flood Zone 1, the development is deemed appropriate according to NPPF and therefore the Exception Test is not required.



5.0 FORMS OF FLOODING

The National Planning Policy Framework requires all forms of flooding to be considered.

5.1 Flooding from Rivers

The Flood Risk map is included as Appendix E. As can be seen from the Flood Risk map, the entire site is located within Flood Zone 1 and therefore, the site is located in Flood Zone 1 with a chance of flooding of less than 0.1% (or 1 in 1000).

The nearest river is the River Irwell, which is located approximately 820m west of the site. Despite this, the risk of flooding to the new development from rivers is considered to be low.

5.2 Flooding from Sea

The site is not at risk of flooding from the sea. The lowest level of the site is approximately 93.70mAOD, i.e., well above tidal flood levels.

5.3 Flooding from Land

Intense rainfall, often of short duration, that is unable to soak into the ground or enter drainage systems can run quickly off land and result in local flooding. The Surface Water Flooding map is included in Appendix E. It can be seen from the map that the majority of the site is classified as having a low or very low risk of surface water flooding.

However, some areas of the site to the north-west corner are classified as having a medium risk of surface water flooding. Assessing the topo survey attached in Appendix C, it can be seen that these areas are actually low points located within the existing Highway Hilton Road. As these areas are to be replaced with the new flexihall building and surrounding hard landscaping, the levels within these areas will be amended and these areas will also have sufficient positive drainage.

Therefore, due to the amended levels and sufficient drainage systems (channel drains and gullies) these areas can be considered to be at low risk from flooding. Therefore, the risk of flooding from overland flows due to surface water flooding is considered to be low and as such the overall site is considered to be at low risk of flooding from surface water/surrounding land.

5.4 Flooding from Groundwater

The Environment Agency groundwater vulnerability maps show the site to be in an area with a medium risk of groundwater flooding. As outlined in Section 2.2, the iD GeoEnvironmental Limited, Geoenvironmental Appraisal Report indicates that groundwater strikes were recorded as shallow as 2.51mbgl, however as these are recorded within the made ground it is envisaged that these are areas of perched water, with the actual groundwater level found at levels around 6.29mbgl.

As such, due to the depths of the groundwater encountered by the site investigation and the fact that there are no basement areas within the proposed development, it is envisaged that the site has a low risk of groundwater flooding. Therefore, the site is considered to be at low risk of flooding from groundwater.

5.5 Flooding from Sewers

A record of Public Sewers surrounding and serving the development site has been obtained from United Utilities and this is included in Appendix F. As can be seen from the United Utilities sewer map, there is a series of combined water sewers running throughout the proposed site. The site also contains a series of private surface and foul water sewers which discharge into the aforementioned combined water sewers.

However, initial surveys have indicated that the existing drainage is deep with some of the United Utilities public combined water sewers being around 8.5mbgl - 9.0mbgl. Therefore, due to the depth of the public sewers within the proposed site, the fact that the public sewers are maintained by United Utilities and also the fact that the proposed drainage for the site will be suitably designed, leads to the conclusion that the site itself is considered to have a low risk of flooding from sewers.

5.6 Flooding from Reservoirs, Canals and Other Artificial Sources

The Reservoir Flood Risk map is included in Appendix E and the nearest reservoir is Elton Reservoir, which is located approximately 1.61km south-west of the site, with the nearest artificial waterbody being the Bury District Angling Society fishing lake which is located

approximately 1.20km west of the site. As such, it can be seen from the map that the site is not at risk of flooding from reservoirs, canals or other artificial sources.

6.0 PROPOSED DEVELOPMENT

6.1 Effect of Proposed Development

As previously outlined in Section 3.0, the existing site covers a total area of 1.488ha but a total area of 0.085ha of the site will remain as per the existing scenario. As such, the proposed development will cover a total area of 1.403ha.

Therefore, the 0.085ha area to remain as per the existing scenario will be excluded from the remainder of this report, with only the 1.403ha development area being used to calculate the existing brownfield runoff rates and proposed surface water discharge rates.

The pre and post development impermeable areas for the 1.403ha development area have been assessed and are indicated on the attached drawing in Appendix G. The comparison between the pre and post development impermeable areas is also summarised below;

Total Development Site Area (ha)	Existing Impermeable Area (ha)	Proposed Impermeable Area (ha)
1.403	1.335	1.336

Therefore, the changes to the existing site will slightly increase the volume of impermeable areas and as such, the proposed development will lead to an increase in the;

- ◆ Volume of surface water ponding on the site.
- ◆ Volume of surface water runoff leaving the site or discharging into surrounding areas.
- ◆ Peak discharge rate from the site.

Accordingly, drainage systems are needed to drain the foul and surface water flows arising from the proposed development. Where possible, any existing drainage networks should be utilised. Appropriate design and construction of these systems as set out in Section 6.3 should ensure that there is no increase in offsite flood risk that would otherwise impact downstream areas.

6.2 Existing Drainage Systems

As can be seen from the United Utilities sewer maps attached in Appendix F, there are a number of public combined water sewers located within and surrounding the proposed site. To the south of the site there is a 675mm diameter public combined water sewer, which runs east to west across the south of the site.

All other public combined water sewers are collected and eventually discharge into the 675mm diameter public combined water sewer, to the south of the site. There are no public

surface water or public foul water sewers either within or surrounding the proposed development site.

As well as public sewers there is also a number of existing private sewers throughout the site. They are mostly a number of small private networks which before discharge into the nearby public combined water sewers. A CCTV survey has been completed and it confirms the arrangement and locations of the existing public and private drainage across the site.

It is not likely that the existing market areas to the east of the site will have any sewer abandonments or diversions, as there are no changes to the existing site layout in this area. However, to the west of the site, the demolition of the existing buildings and construction of a new flexihall building will result in the need to abandon or divert a number of the existing private and public sewers. Any of these public sewer abandonments will require a Section 116 application with United Utilities.

Further CCTV surveys should be undertaken to determine the exact details of the existing drainage across the site and also the possibility of utilising any existing drainage as an outfall should be explored throughout the detailed drainage design process.

6.3 Proposed Drainage Strategy

As outlined previously in Section 6.1, site-wide drainage systems are required to drain the foul and surface water flows arising from the proposed development. The proposed drainage systems must ensure that there is no increase in offsite flood risk that would otherwise impact downstream areas.

6.3.1 Surface Water Drainage

The Building Regulations - Approved Document H (2015) details a hierarchy of potential methods for disposing of surface water as shown below in order of preference:

- ◆ Discharge via infiltration
- ◆ Discharge to watercourse
- ◆ Discharge to sewer

Considering the hierarchy above, the surface water network for the retained area of the existing site should infiltrate where possible. The iD GeoEnvironmental Limited, Geoenvironmental Appraisal Report, did not undertake any BRE365 complaint infiltration tests but it has indicated that the site is underlain by large depths of made ground, up to 2.5mbgl. The made ground is then underlain by superficial deposits of cohesive clays.

Even though no BRE 365 compliant soakaway tests were completed as part of the intrusive site investigation, it is envisaged that infiltration is not suitable across the proposed site. This is due to the potential for inundation settlement resulting from infiltration through the large depths of made ground and also due to the low permeability of cohesive clays.

As the possibility of infiltration has been ruled out by the site investigation, the intention for the development would be to discharge to watercourse. As indicated in Section 5.1, the nearest watercourse is the River Irwell, which is located approximately 820m to the west of

the site. Given the distance through developed third-party land, it has been deemed impractical to discharge into a watercourse.

As such, the only practical solution for discharge of the surface water is discharge to public sewer. As indicated within Section 6.2, the only nearby public sewers are the combined water sewers located within the site and highways surrounding the proposed site. As such, it is envisaged that the surface water runoff from the proposed development will discharge to the surrounding public combined water sewers.

While every effort to use the existing systems should be made, the drainage systems should be designed to suit the proposed site layout and topography which aims to provide an efficient design.

In line with Sewers for Adoption (7th Edition), the requirements for the design of a new surface water drainage systems are as follows:

- ◆ Below ground piped drainage to be sized to accommodate the 1 in 2 year (50% AEP) design storm without surcharge.
- ◆ System to be designed not to flood any part of the site in a 1 in 30 year (3% AEP) design storm.
- ◆ For events in exceedance of the 1 in 30 year design storm and up to and including the 1 in 100 year event, site drainage and topography should be designed where practicable to route surface water run-off away from buildings to safe above-ground storage areas on site, thereby preventing this run-off from leaving the site and increasing flood risk elsewhere.

For each design case described above, the design storm is the critical storm duration for the site conditions. In the case of the 1 in 100 year design storm, a 40% increase in the peak rainfall intensity is applied to allow for the estimated worst case impacts of climate change. This is in accordance with advice, issued by the Environment Agency, which updates previous climate change allowances outlined in the National Planning Policy Framework.

Suitable systems of below ground drainage will be required to contain as a minimum requirement, the 1 in 30 year event. Additionally, any surface water run-off from events that exceed the design capacity of the new drainage system, up to and including the 1 in 100 year (+40%) event, will be retained on-site in safe storage areas.

In line with common practice, it is proposed the surface water discharge from the proposed development should mimic that from the existing site.

In compliance with Section 4.6.2 of the Bury Rochdale And Oldham Strategic Flood Risk Assessment Volume I - SFRA User Guide, it is envisaged that as the existing site is brownfield, Bury Council will require the proposed surface water runoff rates to be restricted to achieve a 50% betterment on the existing brownfield run off rates.

Therefore, an assessment of the existing surface water run-off from the brownfield site has been completed using a simple three pipe network modelled in Micro Drainage. For

the existing 1.403ha site, using an existing impermeable area of 1.335ha. The brownfield runoff assessment is attached in Appendix H and the results are summarised within the table below.

Rainfall Return Period (years)	Existing Brownfield Runoff Rate (L/s)
1 Year	142.6
Qbar (2 Year)	175.0
30 year	334.8
100 year	479.1

As such, applying a 50% reduction to comply with the Bury Rochdale And Oldham Strategic Flood Risk Assessment Volume I - SFRA User Guide, the maximum surface water discharge rate for the entire site is **71.3 L/s**.

Using the total post development impermeable area of 1.335ha, at the restricted discharge rate of 71.3 L/s, for the 1 in 100 year + 40% return period design storm, attenuation storage is required to prevent any flooding across the site.

As seen in from the Outline Drainage Strategy Drawing attached in Appendix I, it is anticipated that the attenuation storage will be provided in the form of an attenuation tank and the surface water drainage network itself, with a vortex flow control device used to restrict the discharge rate to the required brownfield runoff rates indicated above.

The surface water drainage calculations have also been included within Appendix I and as can be seen the proposed surface water drainage and attenuation storage prevent any flooding for all rainfall events up to and including the 1 in 100 year + 40% climate change event and also meet the required brownfield discharge restrictions. This is summarised in the table below.

Rainfall Return Period (years)	Existing Greenfield Runoff Rate (L/s)	Proposed Discharge Rate (L/s)	Proposed Betterment (%)
1 Year	142.6	28.6	80%
Qbar (2 Year)	175.0	40.2	77%
30 year	334.8	69.2	79%
100 year	479.1	71.2	85%

As can be seen from the Outline Drainage Strategy Drawing attached in Appendix I, the surface water drainage collects the runoff from the site area via green roofs, gullies, linear drainage channels and rainwater downpipes and conveys the surface water runoff to the north west of the proposed site.

Here, the surface water runoff is restricted via a vortex flow control prior to discharging into the existing public combined water sewer. The vortex flow control device restricts the

runoff to the required brownfield discharge rates, for all rainfall events up to and including the 1 in 100 year +40% climate change event.

The surface water drainage strategy and discharge rate should be confirmed via more detailed discussions with Bury Metropolitan Borough Council and United Utilities prior to the commencement of any works.

As can be seen from the Outline Drainage Strategy Drawing attached in Appendix I, an area of public walkway to the north east is needing to be drained. However given it's distance from the rest of the areas to be drained, surface water pipes will need to be installed underneath the existing market hall. The possibility of draining this system separately should be explored as it would eliminate the need for intrusive groundworks beneath the existing structure. This should be discussed with United Utilities and the LLFA.

6.3.2 SuDS Summary

As outlined within the summary table below, all SuDS techniques have been considered for this development;

SuDS Technique	Suitable for This Development?	Reasoning
Green Roof	✓	Suitable and incorporated.
Rainwater Harvesting	✗	Impractical due to lack of demand for greywater.
Basins & Ponds	✗	Unsuitable due to lack of available space across the site.
Filter Strips & Swales	✗	Unsuitable due to impermeable strata and lack of suitable locations across the site.
Bio-retention Areas	✗	Unsuitable due to lack of available space across the site.
Infiltration Techniques	✗	Unsuitable due to impermeable strata.
Permeable Surfaces	✗	Unsuitable due to impermeable strata and only minimal areas available across the site.
Tanked/Piped Systems	✓	Suitable and incorporated.

Green roof areas have been incorporated across the entire new canopy roofs above the existing market areas to the east of the site. Due to the requirement for plant and other equipment on the roof of the flexihall building, there is only minimal areas available to incorporate a green roof and therefore this has been deemed impractical for the flexihall building.

Rainwater harvesting was also considered but due to a lack of greywater demand and the cost associated with tanks and pumping of the separate system, it has been deemed as impractical to include a rainwater harvesting system.

Due to a lack of available, suitable space across the urban site, the use of basins, ponds or swales have been deemed as impractical. The lack of available areas and impermeable strata have also resulted in the use of any bio-retention areas, filter strips, permeable surfaces or infiltration techniques being impractical for the proposed site.

Finally, the use of oversized pipe networks has been included as well as the use of a below ground cellular attenuation tank, to store the surcharged surface water runoff from the site.

The use of specific SuDS techniques across the site will be determined during the detailed design process but where possible, the SuDS summary should be adhered to as close as reasonably possible.

6.3.3 Water Quality Assessment

Managing the water quality of the surface water runoff from the proposed development is important to ensure that the receiving surface waters or groundwater are well protected. Generally, this can be achieved through the use of well-designed SuDS systems which provide treatment and pollution removal to the surface water runoff.

Standard S3 of the Statutory National Standards for Sustainable Drainage Systems (2018) details the water quality management and addresses the drainage design requirements to minimise the potential pollution risk.

As the proposed development consists of roof areas as well as low traffic roads, in accordance within Table G3.2 of the Statutory National Standards for Sustainable Drainage Systems (2018) the pollution hazard level is low and as such the simple index approach can be used to assess the treatment requirements for the low risk of pollution.

The simple index approach is outlined within Chapter 26 of CIRIA Report C753 - The SuDS Manual. Therefore, using Table 26.2 and applying the proposed site description above, results in the pollution hazard indices being; TSS - 0.5, Metals - 0.4 and Hydrocarbons - 0.4.

Assessing this against Table 26.3 of CIRIA Report C753 - The SuDS Manual, a proprietary treatment system (e.g. an oil separator) would likely be enough given the low hazard level from the proposed development. However, given the majority of the site will be covered with a green roof canopy, this can be considered as a bio-retention, proprietary treatment system and therefore it is not envisaged that an oil separator will be required.

The use of specific SuDS techniques across the site will be determined during the detailed design process but where possible, the above SuDS summary should be adhered to as close as reasonably possible.

6.3.4 Foul Water Drainage

Foul water drainage disposal is set out in Part H of the Building Regulations in order of priority the preferred methods are;

1. Public sewer
2. Septic tank
3. Cesspool

The foul water system shall be designed in accordance with;

- ◆ BS EN 752:2017 (Drain and sewer systems outside buildings)
- ◆ Sewers for Adoption (7th Edition)
- ◆ Planning Practice Guidance and the National Planning Policy Framework document (Department for Communities and Local Government, July 2021).
- ◆ BS EN 12056-2:2000 (Drainage systems inside buildings)
- ◆ Building Regulations Approved Document H, Drainage and waste disposal. (Office of the Deputy Prime Minister, December 2015).

As can be seen from the Outline Drainage Strategy Drawing attached in Appendix I, the foul water drainage collects the runoff from the new flexihall building and conveys the foul water to the north west of the proposed site.

Here the foul water runoff discharges via gravity into the existing public combined water sewer. It is anticipated that the foul water can discharge into the public sewer at unrestricted rates.

Further CCTV surveys will be required to confirm the levels, location and condition of the proposed connection manhole. Should this outfall location be deemed unsuitable the possibility of discharging either south or west of site should be explored. However this would require correspondence with third party landowners and possible disruption of highways.

The foul water drainage strategy and unrestricted discharge rate should be confirmed via more detailed discussions with Bury Council and United Utilities prior to the commencement of any works.



7.0 FUTURE MANAGEMENT & MAINTENANCE

The proposed drainage solution uses SUDS techniques in accordance with the CIRIA SUDS Manual C753. The surface water run-off from the proposed development is restricted using a vortex flow control device and the attenuated run-off is stored using a below ground cellular attenuation tank.

It is envisaged that the following components have been or will be included within the drainage strategy for the proposed development:

- ◆ Inspection chambers, manholes and catchpits.
- ◆ Pipes.
- ◆ Drainage channels and gullies.
- ◆ Vortex flow control device.
- ◆ Green Roofs.
- ◆ Cellular Attenuation Storage.

A suitable maintenance strategy should be adopted to ensure the drainage network is cleaned regularly and the routine maintenance and cleansing regime should be documented. It is assumed that the proposed drainage will remain private and therefore maintenance of the surface and foul water drainage systems will be the responsibility of Bury Council or an on-site facilities management team and therefore a copy of the final construction drainage layout should be provided in the final Operations and Maintenance Manual.

As such, the maintenance of the specified SuDS should be included within the developments Operation and Maintenance Manual and should be detailed in accordance with the CIRIA SuDS Manual C753, as per the operation and maintenance guidance outlined below.

7.1 General Maintenance & Inspection Requirements

- ◆ No work shall be carried out on the drainage system without permission from a nominated person, who has access to information/a working knowledge of the system.
- ◆ Maintenance/inspection work shall be carried out in a safe/planned manner.
- ◆ All work is to be carried out by competent persons suitably trained and equipped in accordance with current statutory safe working policies.
- ◆ Entry into confined spaces shall be kept to a minimum and be restricted to suitably qualified/equipped persons working in accordance with current statutory safe working policies.
- ◆ Drainage systems shall be inspected on a regular basis or should any problems be suspected. Any debris/defects discovered shall be recorded and a programme of cleaning/ repair initiated. Urgent repairs/cleaning shall be actioned as soon as practicable.
- ◆ It is recommended that the drainage system is inspected as a minimum twice a year, with the system also being inspected after any major storm event.
- ◆ Clearing of the drainage system can be achieved by a number of methods depending on the nature of the work;
 - o Rodding - Manual/Mechanical with flexible rods.
 - o Jetting - High pressure water jetting.
 - o Plunging.

7.2 Inspection Chambers, Manholes and Catchpits

The appropriate health and safety equipment must be used when accessing manholes/catchpits. Confined space certificates must be held by any personnel entering a manhole and the appropriate permits should be obtained from the Maintenance Manager prior to any access. The following operations should be carried out annually.

- ◆ Covers of inspection chambers and manholes shall be removed and the sides, benchings and channels cleared.
- ◆ Accumulated deposits of silt in inspection chambers, catchpits and manholes shall be removed. Any traps shall then be plunged and thoroughly flushed out with clean water. This should be completed in Autumn, after leaf fall.

- ◆ Main and branch drains shall be cleared as required and afterwards be flushed with clean water. Any obstructions found shall be removed and not flushed down the system.
- ◆ Covers of inspection chambers, manholes and catchpits shall be replaced, bedded in suitable grease or other sealing material as required and bolted/locked down as appropriate. Missing bolts and broken items shall be replaced in accordance with the manufacturer's details.

7.3 Pipes

Regular inspection and maintenance are important to identify areas which may have become obstructed/clogged and may not be draining correctly, as failure to do so would expose the development to a greater level of flood risk.

Pipes are proprietary products and therefore the materials used can vary across the site. As such, where used the manufacturer's recommendations should be followed. Access for maintenance of the pipes is provided through inspection chambers and manholes. The below table sets out the maintenance schedule for the pipe components of the proposed drainage systems.

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Inspect for evidence of poor operation via water levels. If required take remedial action.	Monthly for 3 months, then six-monthly intervals. Also, 48 hours after large storms.
	Check and remove large debris and/or vegetation growth near pipe runs.	Monthly or as required.
Remedial Actions	Rod through poorly performing runs as initial remediation.	As required.
	If continued poor performance jet and CCTV survey poorly performing runs.	As required.
	Seek advice as to remediation techniques suitable for the type of performance issue.	As required, if above actions do not improve performance.
Monitoring	Initial Inspection should be provided as post construction CCTV survey.	N/A
	Inspect/check all inlets, outlets and overflows to ensure they are in good condition and operating as designed.	Monthly for 3 months, then six-monthly intervals. Also, 48 hours after large storms.

7.4 Drainage Channels and Gullies

Channels and gullies should be inspected and cleaned in accordance with the manufacturer's details. Channel units can be cleaned through the use of a high-pressure hose; this can be fed into the channel system through access units strategically placed along the channel run. The throat section of channel units should be kept clear at all times to ensure uninterrupted flow of surface water into the drainage channel and any debris within the throat should be removed.

Locking bolts should be replaced and sufficiently tightened, taking care that the bolt heads do not stand above the top surface of the cover or grate. If covers are allowed to move within their frame, this may cause damage to the frame or seating. The below table

sets out the maintenance schedule for the drainage channel and gullies components of the proposed drainage systems.

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Litter and debris removal.	Monthly or as required.
	Check and remove large debris and/or vegetation growth near pipe runs.	Monthly or as required.
	Inspect for evidence of poor operation and/or weed growth. If required take remedial action. Inspect silt accumulation rates and establish appropriate brushing frequencies.	Monthly for 3 months, then six-monthly intervals. Also, 48 hours after large storms.
Remedial Actions	Inspect access/outlet boxes and rod through poorly performing channels and outlets as initial remediation.	As required.
	Seek advice as to remediation techniques suitable for the type of performance issue.	As required, if above actions do not improve performance.
Monitoring	Initial Inspection including channel outlet boxes and gully sumps.	Monthly for 3 months, then six-monthly intervals. Also, 48 hours after large storms.

7.5 Vortex Flow Control Device

Regular inspection and maintenance is important to identify if the vortex flow control device has become obstructed/clogged and may not be functioning correctly, as failure to do so would expose the development to a greater level of flood risk.

Vortex flow control devices are proprietary products and therefore can vary from manufacturer to manufacturer. As such, where used the manufacturer's recommendations should be followed.

- ◆ Normally, little maintenance is required as there are generally a vortex flow control device has no moving parts.
- ◆ If blockages occur, they tend to do so at the intake of the vortex flow control device.
- ◆ Vortex flow control devices are generally fitted with a pivoting by-pass door, which allows the manhole chamber to be drained down should blockages occur.
- ◆ The smaller type conical units, below the minimum recommended size, are also supplied with rodding facilities or vortex suppressor pipes as standard.
- ◆ Following installation of the vortex flow control device it is vitally important that any extraneous material i.e., Building materials are removed from the unit and the chamber.
- ◆ After the system is made live, it is recommended that each unit be inspected monthly for three months and thereafter at six monthly intervals with hose down if required. Units should also be inspected within 48 hours after large storms.

7.6 Green Roofs

Regular inspection and maintenance is important to identify if the inlets/outlets have become obstructed/clogged and may not be functioning correctly, as failure to do so would expose the development to a greater level of flood risk.

The maintenance requirements for green roofs are outlined within Table 12.5 of the CIRIA SUDS Manual C753. An extract of that table is given below to set out the maintenance schedule for the green roof component of the proposed drainage systems.

TABLE 12.5 Operation and maintenance requirements for green roofs		
Maintenance schedule	Required action	Typical frequency
Regular inspections	Inspect all components including soil substrate, vegetation, drains, irrigation systems (if applicable), membranes and roof structure for proper operation, integrity of waterproofing and structural stability	Annually and after severe storms
	Inspect soil substrate for evidence of erosion channels and identify any sediment sources	Annually and after severe storms
	Inspect drain inlets to ensure unrestricted runoff from the drainage layer to the conveyance or roof drain system	Annually and after severe storms
	Inspect underside of roof for evidence of leakage	Annually and after severe storms
Regular maintenance	Remove debris and litter to prevent clogging of inlet drains and interference with plant growth	Six monthly and annually or as required
	During establishment (ie year one), replace dead plants as required	Monthly (but usually responsibility of manufacturer)
	Post establishment, replace dead plants as required (where > 5% of coverage)	Annually (in autumn)
	Remove fallen leaves and debris from deciduous plant foliage	Six monthly or as required
	Remove nuisance and invasive vegetation, including weeds	Six monthly or as required
	Mow grasses, prune shrubs and manage other planting (if appropriate) as required – clippings should be removed and not allowed to accumulate	Six monthly or as required
Remedial actions	If erosion channels are evident, these should be stabilised with extra soil substrate similar to the original material, and sources of erosion damage should be identified and controlled	As required
	If drain inlet has settled, cracked or moved, investigate and repair as appropriate	As required

7.7 Cellular Attenuation Tank

Regular inspection and maintenance is important to identify if the inlets/outlets have become obstructed/clogged and may not be functioning correctly, as failure to do so would expose the development to a greater level of flood risk.

The maintenance requirements for cellular attenuation tanks are outlined within Table 21.3 of the CIRIA SUDS Manual C753. An extract of that table is given below to set out the maintenance schedule for the cellular attenuation tank component of the proposed drainage systems.

TABLE 21.3 Operation and maintenance requirements for attenuation storage tanks		
Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary.	Annually
	Remove sediment from pre-treatment structures and/or internal forebays	Annually, or as required
Remedial actions	Repair/rehabilitate inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required

It should be noted that the Main Contractor should provide a Verification Report, including photographic evidence, to demonstrate that the drainage has been constructed as per the design drawings. As-built drawings should as be supplied by the Main Contractor, where the construction of the drainage varies from the design construction status drawings.

8.0 CONCLUSIONS

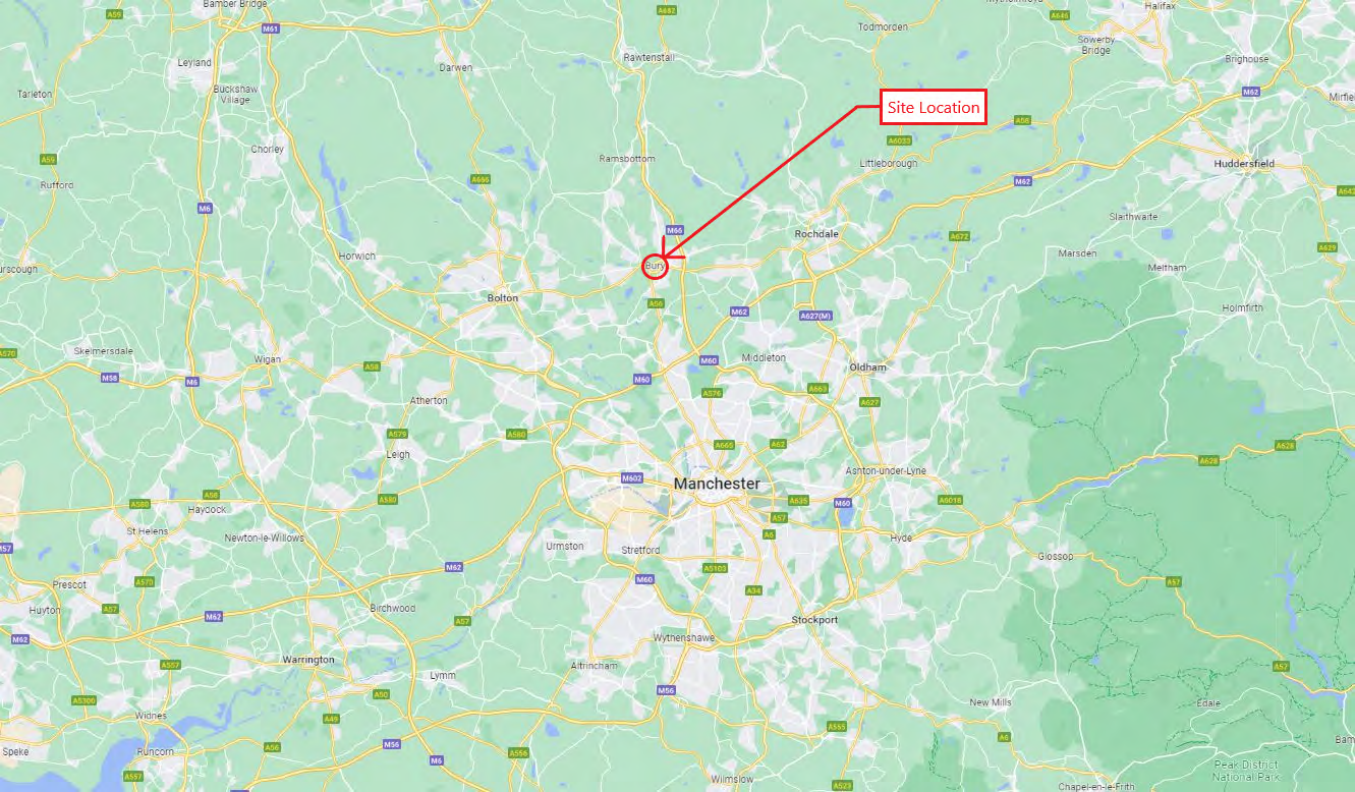
- ◆ The site is located within Flood Zone 1 with a low probability of flooding from all sources.
- ◆ The British Geological Survey (BGS) 1:50,000 Bedrock geology maps shows that the ground comprises of sandstone, siltstone and mudstone. This would indicate that the underlying strata is impermeable and infiltration is not suitable. This has been confirmed via an intrusive site investigation.
- ◆ Due to the distance across developed third-party land, discharging the surface water from the site to the nearest watercourse has been deemed as impractical. This and the lack of public surface water sewers within and around the proposed site results in the only practical option for the disposal of the surface water runoff from the proposed development is to discharge into the public combined water sewers within the site boundary.
- ◆ The surface water discharge is to be restricted a 50% betterment on the existing brownfield runoff rates, for all rainfall events up to and including the 100 year plus 40% climate change design storm, to comply with LLFA requirements. The proposed surface water drainage design meets this criteria and also ensures there is no flooding for all rainfall events up to and including the 100 year plus 40% climate change design storm.
- ◆ The surcharged runoff is to be restricted using a vortex flow control device and the surcharged runoff attenuated using the proposed surface water drainage network itself and also a below ground cellular attenuation tank located to the north of the proposed flexihall building.
- ◆ The foul water drainage is to discharge into the existing United Utilities public combined water sewers to the north west of site, via gravity. It is anticipated that the foul water can discharge into the public sewer at unrestricted rates.
- ◆ The external ground levels around proposed buildings shall fall away from the proposed building with any new levels being designed to ensure any overland flood routes, for events in excess of the 100 Year + 40% CC, exit towards the surrounding highways, for use in exceptional circumstances.



9.0 RECOMMENDATIONS

- ◆ The surface water drainage strategy and discharge rates should be confirmed via more detailed discussions with Bury Council and United Utilities prior to the commencement of any works.
- ◆ The foul water drainage strategy and unrestricted discharge rate should be confirmed via more detailed discussions with Bury Council and United Utilities prior to the commencement of any works.
- ◆ Further CCTV surveys should be undertaken to confirm the location, invert levels and condition of the public and private sewers around the proposed outfall locations.
- ◆ Further discussions with United Utilities and the LLFA should be undertaken, with regards to the possibility of draining the public walkway to the north east of site without restriction. Distribution of proposed discharge rates to account for the unrestricted discharge from this area would need to be calculated and confirmed.
- ◆ The use of specific SuDS techniques across the site should be determined during the detailed design process but where possible, the SuDS summary should be adhered to as close as reasonably possible with SuDS techniques incorporated, where possible, across the site.

Appendix A – Site Location Plan

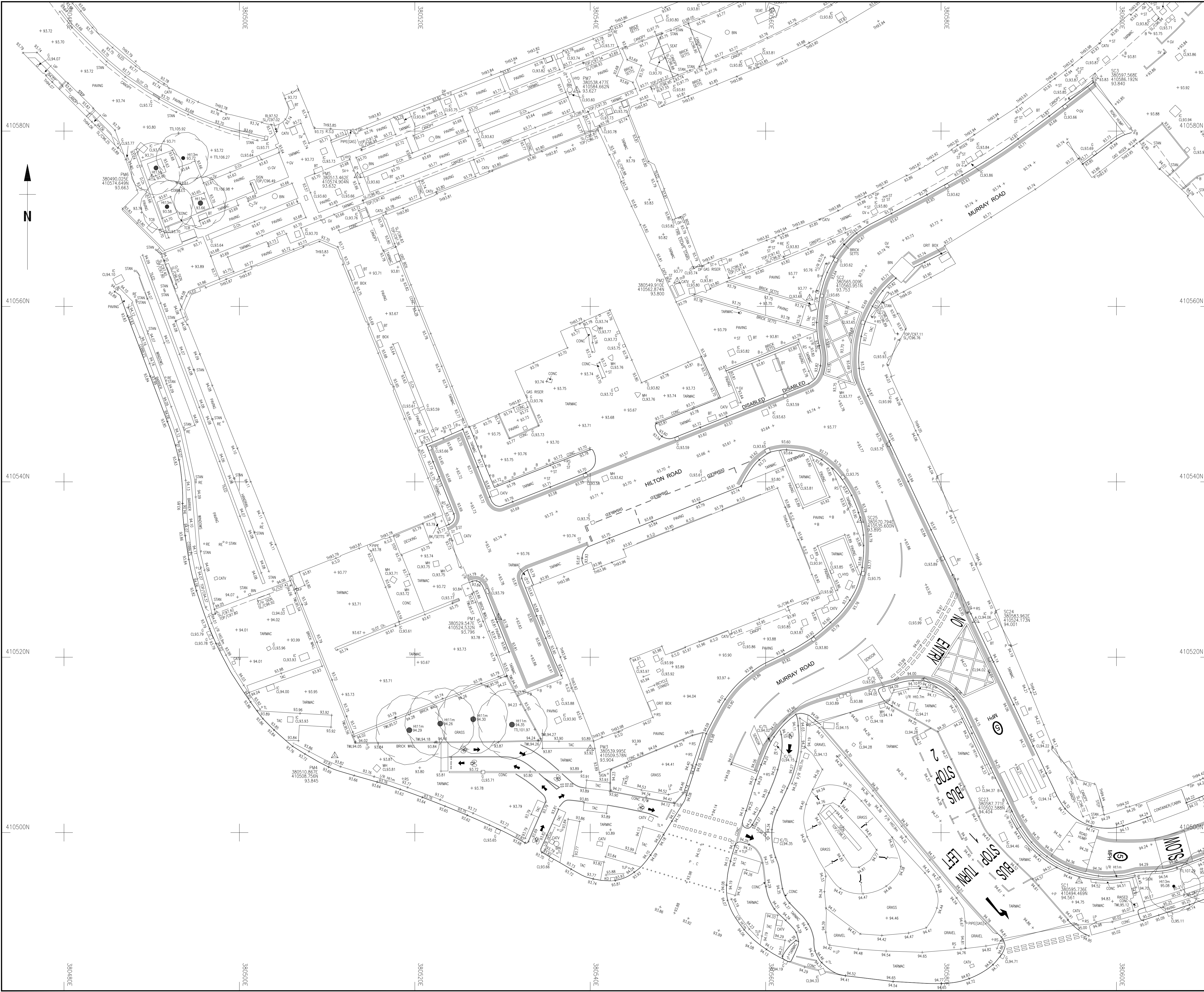


Site Location

Appendix B – Aerial Photograph



Appendix C – Topographic Survey



Survey Notes
Grid: Local Plane Grid Fixed to National Grid at Survey Control Station SC2
Levels: OS Datum from GNSS positioning converted using the National Geoid Model OSGM15

Notes

Topographical Survey Legend

BUILDINGS AND WALLS	GENERAL INFORMATION
Building Open Shed Ruin Passage Wall with Height Retaining Wall	Petrol Pump Basement Light Footbridge Ditch Type Channel Slat Type Channel Grate Type Channel Tactile Paving Crown Barrier Column Station Car Vacuum Air Valve Trough Chimney Telephone Call Box
FENCE STYLES AND DESCRIPTIONS	OVERHEAD FEATURES
Close Boarded Corrugated Iron Chainlink Hendral Lattice Iron Railings Miscellaneous Palisade Post & Chain Post & Rail Post & Wire Post & Barbed Wire Wire mesh Silt Gate Fence line style	Electricity Pylon Electricity Telephone
ROADS	WATER FEATURES
Kerbs Edge of Surfacing Pedestrian Crossing Track Footpath	Canal Stream Ditch Weir Culvert Grp (Land Drain) Spring
STREET FURNITURE	RELIEF AND VEGETATION
Balisha Beacon Bus Stop Cable Eye Coal Chute Closed Circuit TV Drain Electricity Pole Flood Light Flag Staff Lamp Post Letter Box Name Plate (street) Measuring Ring Mile Post or Mooring Post Service Marker Mile Stone Post Parking Meter Reflector Post Reading Eye Road Sign Speed Camera Information Sign Stop Traffic Light Telegraph Pole Traffic Light Push Button Post Traffic Light Control Control Box Eave Level Electricity Box Gas Box	Hedge Edge of wood/Bushes Stump Individual Tree Slopes with Height Greater than 1m Cliff Face Marsh Reeds
INSPECTION CHAMBERS AND PIPES	LEVEL AND HEIGHT INFORMATION
Inspection Cover (Dial) Inspection Cover (Comms) Inspection Cover Traffic Signals Gully Kerbs Outlet Vent Pipe Down Pipe Rain Water Pipe Soil Pipe Gas Pipe Unable to lift cover Slop Top Slop Valve Longhole Hydrant Cottin Rod Gas Valve Water Meter Washout Reading Eye	Standard Spot Height Precision Spot Height Bed Level Water Level Soft Level Threshold Level Cover Level Invert Level Pipe Soft Level Top of Level Finished Floor Level Top of Tank Level Ridge Level Eave Level Roof Hip Level Top of Canopy Level Window Sill Level Window Head Level Spring Level Arch Level Cable Level Top of Wall Level Underneath of Beam Level General Height
SURVEY INFORMATION SIGNS	GEOTECHNICAL INFORMATION
Permanent Ground Marker O.S. Trig Station O.S. Bench Mark	Borehole Trial Pit Monitor Pin Probe Hole Window Sample

Rev.	Date	Description

Accreditations

MALCOLM HUGHES
CHARTERED LAND SURVEYORS

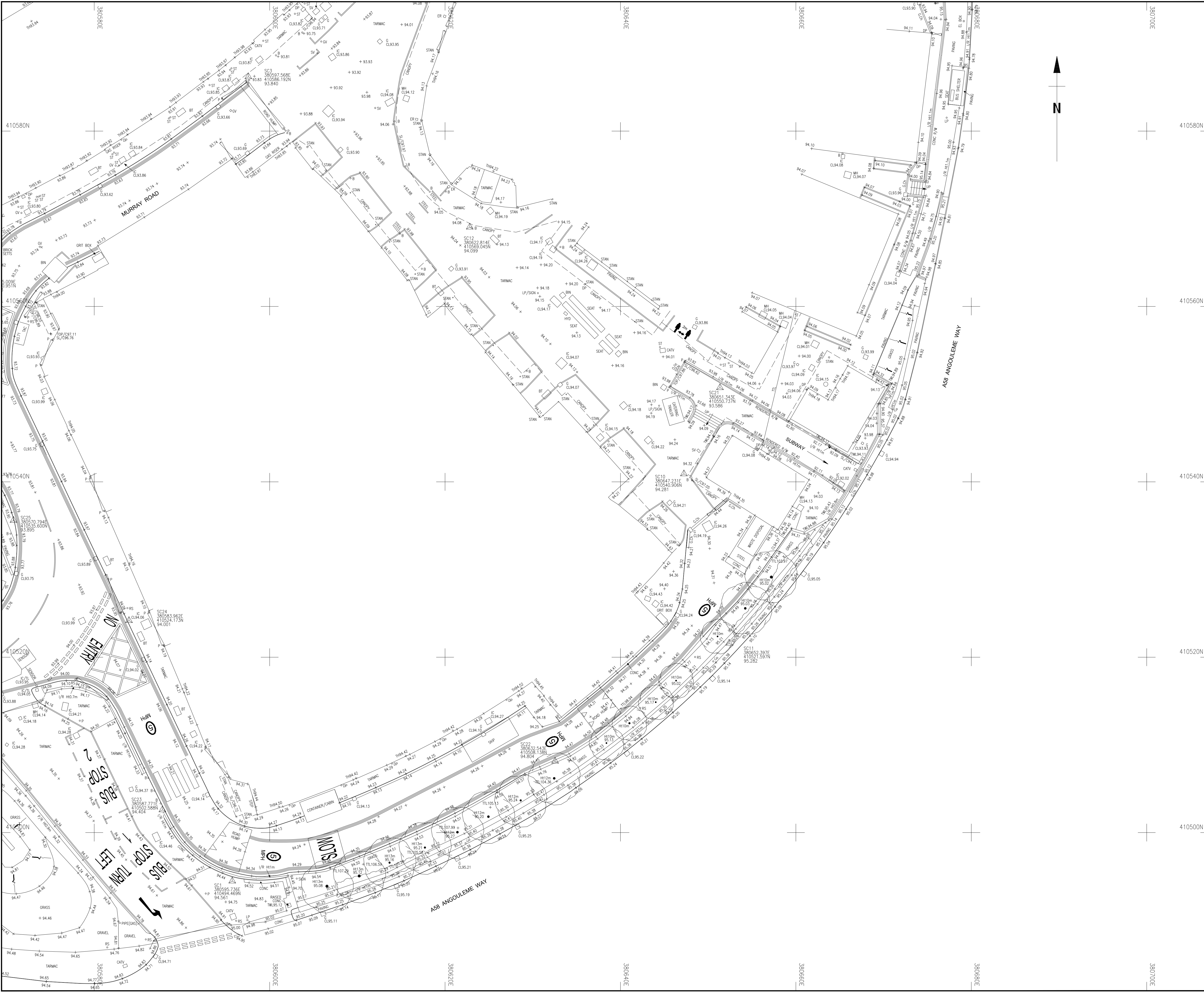
65 Cross Street, Sale, Manchester
M33 7HF, Tel: 0161 905 1265
www.malcolmhughes.co.uk
survey@mh.co.uk

Client
VINCI CONSTRUCTION UK LTD
DITTON ROAD, WIDNES
CHESHIRE, WA8 0PG

Project
BURY MARKET

Drawing Title
TOPOGRAPHICAL SURVEY
Sheet 1 of 3

Drawn By AW	18/01/22	Survey Date December 2021
Checked by EAD	14/01/22	Scale A1@1:200
Drawing No 57968 / 1	Revision	



Survey Notes

Grid: Local Plane Grid Fixed to National Grid at Survey Control Station SC2

Levels: OS Datum from GNSS positioning converted using the National Geoid Model OSGM15

Notes

Topographical Survey Legend

BUILDINGS AND WALLS	GENERAL INFORMATION
Building	Petrol Pump
Open Road	Basement Light
Ruin	Footbridge
Passage	Drain Type Channel
Wall with Height	Spot Type Channel
Retaining Wall	Grate Type Channel
	Tactile Paving
	Cross Barrier
	Column
	Car Vacuum
	Through
	Chimney
	Telephone Call Box

FENCE STYLES AND DESCRIPTIONS

Close Boarded	C/B
Corrugated Iron	C/I
Chainlink	C/L
Hendral	H/R
Intervenor	I/V
Iron Railings	I/R
Lattice	L/F
Miscellaneous	M/C
Palisade	P/L
Post & Chain	P/C
Post & Rail	P/R
Post & Wire	P/W
Post & Barbed Wire	P/BW
Wire mesh	W/M
Silt	S
Gate	G
Fence Inset	I

ROADS

Kerbs	K
Edge of Surfacing	E
Pedestrian Crossing	P
Track	T
Footpath	F

STREET FURNITURE

Banish Beacon	B
Bus Stop	BS
Car Eye	C
Coal Chute	CC
Closed Circuit TV	CCTV
Drain	D
Electricity Pole	E
Flood Light	FL
Flag Staff	FS
Lamp Post	LP
Letter Box	L
Name Plate (street)	NP
Mast	M
Mile Post or Mooring Post	MP
Service Marker	SM
Mile Stone	MS
Post	P
Parking Meter	PM
Reflector Post	RP
Reading Eye	RE
Road Sign	RS
Speed Camera	SC
Information Sign	IS
Stop	S
Traffic Light	TL
Telegraph Pole	TP
Traffic Light Push Button Post	TLPB
Traffic Light Control	TLC
Control Box	CB
British Telecom Box	BTB
Electricity Box	ELB
Gas Box	GB

INSPECTION CHAMBERS AND PIPES

Inspection Cover (Duct)	IC
Manhole	MH
British Telecom Cover	BT
Inspection Cover (Comms)	IC/COM
Inspection Cover Traffic Signals	IC/TL
Gully	G
Kerbs Outlet	KO
Vent Pipe	VP
Down Pipe	DP
Rain Water Pipe	RWP
Soil Pipe	SP
Gas Pipe	G-PIPE
Unusable to lift cover	U
Stop Top	ST
Stop Valve	SV
Longhole	LH
Hydrant	HD
Catch Pit	CP
Gas Valve	GV
Water Meter	WM
Washout	WO
Reading Eye	RE

OVERHEAD FEATURES

Electricity Pylon	EP
Electricity	E
Telephone	OTL

WATER FEATURES

Canal	C
Stream	S
Ditch	D
Weir	W
Culvert	C
Silt (Land Drain)	S
Spring	SPR

RELIEF AND VEGETATION

Hedge	H
Edge of wood/Bushes	E
Stump	STUMP
Individual Tree	T
Slopes with Height Greater than 1m	S
Cliff Face	C
Reeds	R

LEVEL AND HEIGHT INFORMATION

Standard Spot Height	+123.45
Precision Spot Height	+123.456
Bed Level	+BL23.92
Water Level	+WL24.92
Soft Level	+SL25.92
Threshold Level	+TL26.98
Cover Level	+CL28.45
Invert Level	+IL28.15
Pipe Soft Level	+PSL5.00
Floor Level	+FL5.00
Finished Floor Level	+FFL5.00
Top of Tank Level	+TTL5.00
Eave Level	+EL5.00
Ridge Level	+RL5.00
Roof Hip Level	+RHL5.00
Top of Roof Level	+TRL5.00
Top of Canopy Level	+TCL5.00
Underneath of Canopy Level	+UCCL5.00
Window Sill Level	+WSL5.00
Arch Level	+AL5.00
Cable Level	+CL5.00
Top of Wall Level	+TWL5.00
Underneath of Beam Level	+UBL5.00
General Height	+H5.00

SURVEY INFORMATION SIGNS

Permanent Ground Marker	PGM
O.S. Trig Station	OS
O.S. Bench Mark	OBM

GEOTECHNICAL INFORMATION

Borehole	BH
Top of Pit	TOP
Monitor Pin	MP
Probe Hole	PH
Window Sample	WS

Rev.	Date	Description

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CHESHIRE, WA8 0PG

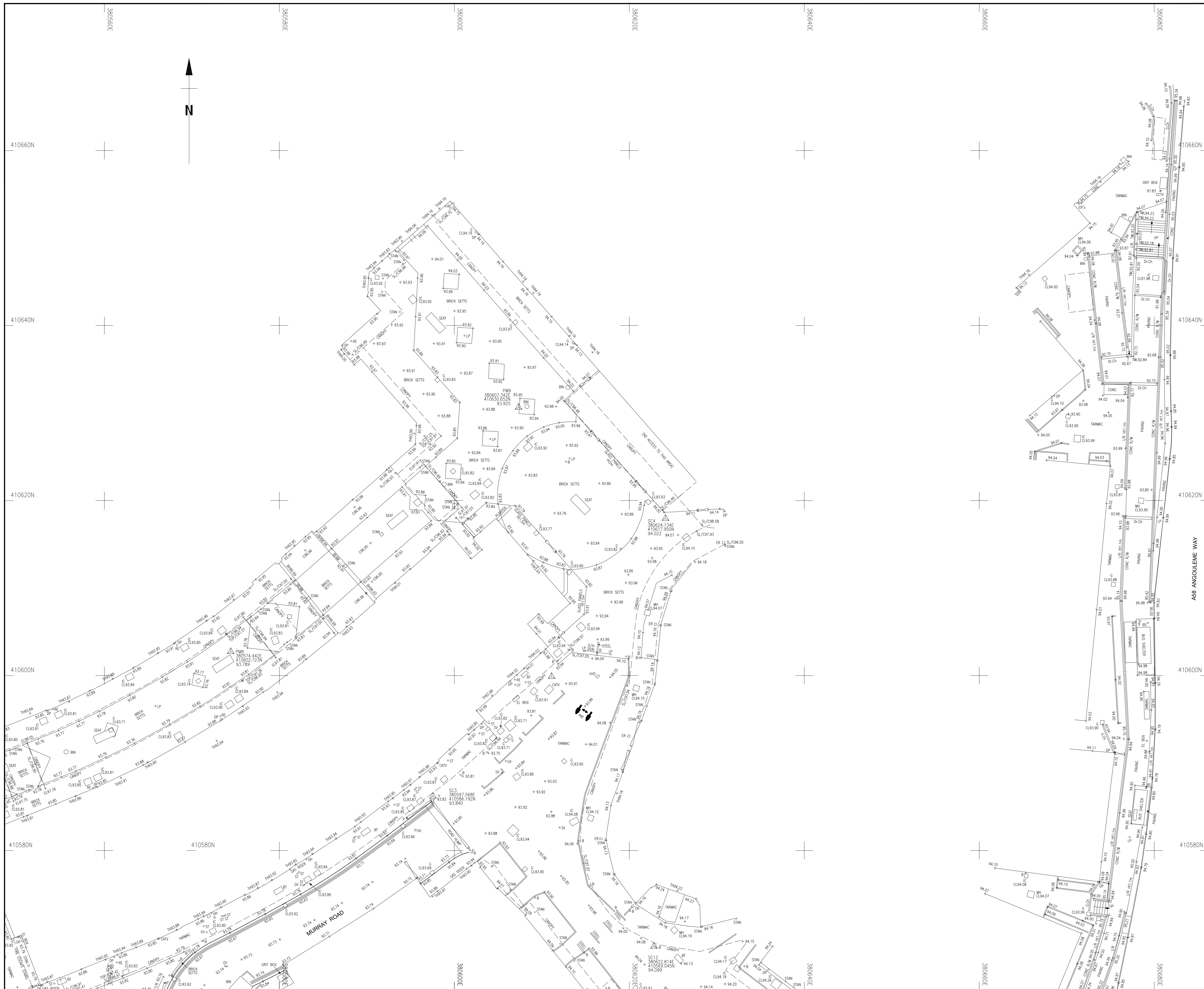
Project

BURY MARKET

Drawing Title

TOPOGRAPHICAL SURVEY
Sheet 2 of 3

Drawn By	AW	18/01/22	Survey Date	December 2021
Checked by	EAD	14/01/22	Scale	A1@1:200
Drawing No	57968 / 2		Revision	

[illegible]

Rev.	Date	Description



**MALCOLM
HUGHES**

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Accreditations








Client

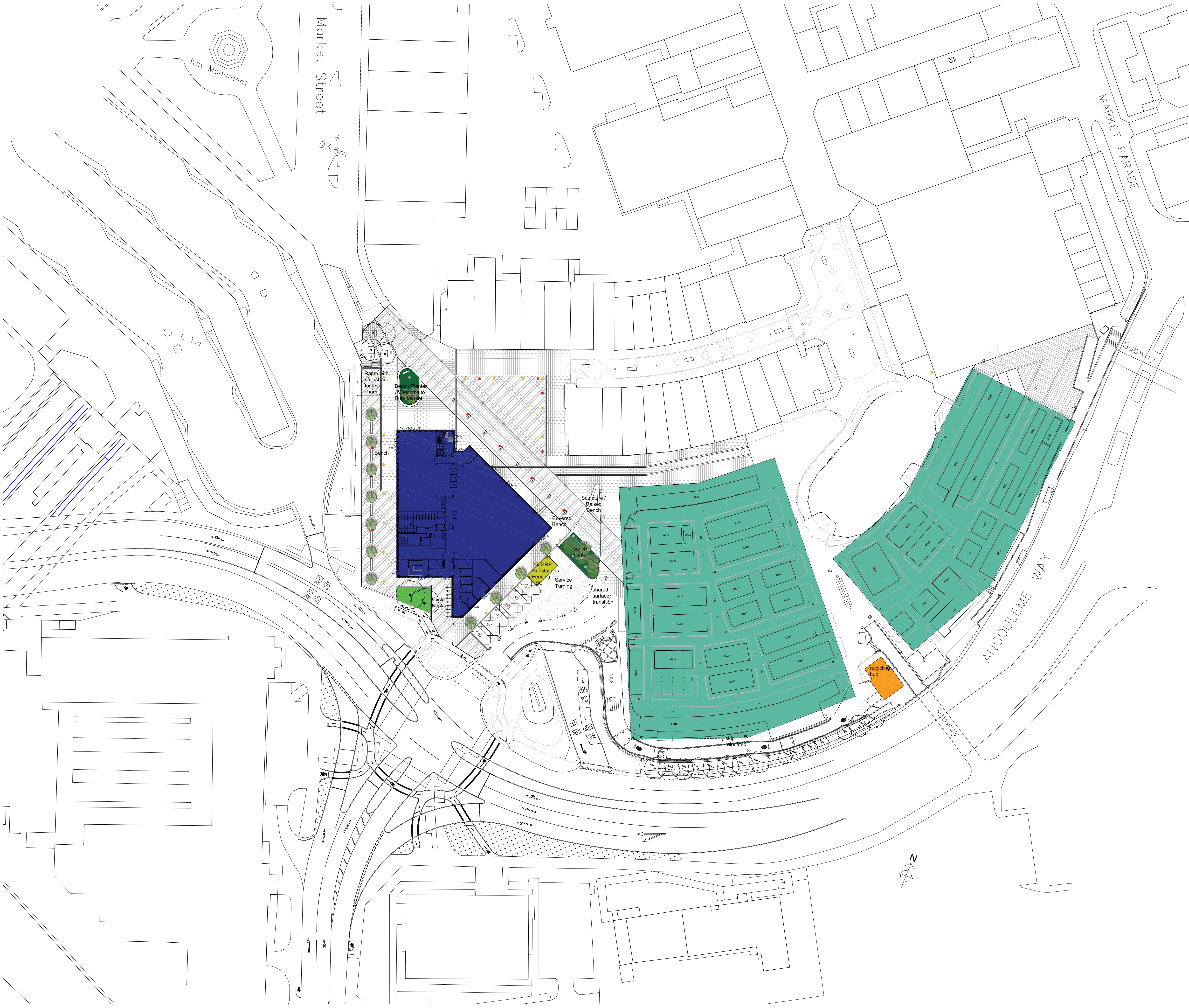
VINCI CONSTRUCTION UK LTD
DITTON ROAD, WIDNES
CHESHIRE, WA8 0PG

Project	BURY MARKET
---------	-------------

Drawing Title	TOPOGRAPHICAL SURVEY Sheet 3 of 3
---------------	---

Drawn By AW 18/01/22	Survey Date December 2021
Checked by EAD 14/01/22	Scale A1@1:200
Drawing No 57968 / 3	
Revision	

Appendix D – Proposed Site Plan



Do not scale off this drawing. All dimensions to be checked on site prior to manufacture and construction. This drawing is the property of Just-H Architects and should not be reproduced without permission. All discrepancies to be brought to the attention of the architect immediately. This drawing to be read in conjunction with the specification / bill of quantities and related drawings.

REVISION			
P01	FIRST ISSUE	07.10.21	RCO
P02	Flexihall moved to allow for access adjacent to bus station. Landscaping amended to create shared access across Murray road. New junction details added.	22.11.21	RCO
P03	Margaret Block reinstated	17.01.22	RCO
P04	Canopy geometry amended to suit topo information, landscaping design updated to incorporate shared surface vehicle movements	23.02.22	RCO
P05	Market canopy column positions and roofs amended following existing survey	14.03.22	CT
P06	Amended to suit revised building design, accessible parking added	10.05.22	RCO
P07	Flexihall geometry to south entrance amended, landscaping detail to west added.	13.05.22	RCO
P08	Service Layby amended	16.05.22	RCO
P09	Flexihall footprint amended and landscaping altered to suit	23.05.22	RCO
P10	Parking bays and service layby amended to Highways Consultant information	30.05.22	RCO
P11	Enlarged service area option shown	04.07.22	RCO
P12	Landscaping to south of Flexihall & landscaping specification amended.	12.07.22	RCO
P13	Amended to show landscaping option with no grass	25.07.22	RCO
P14	Amended following feedback on proposed public park layout design	30.07.22	RCO
P15	Amended following client meeting. Provisional areas added	19.08.22	JG
P16	Plan updated to include part covered walkway / sub station relocation	08.09.22	JG

Landscape key Plan

- Existing Buildings
- New Flexihall
- Market Canopy
- Recycling Hub
- Tarmac
- Grass
- Resin bonded gravel
- Marshalls Blister Paving - Charcoal
- Concrete flag paving - Marshalls Conservation X / Modal, or similar laid in guaged widths and random lengths, mix of colours TBC.
- Planting bed with low level planting as Landscape Architect's details
- Contrast strip paving - Marshalls Conservation X / Modal or similar 900 x 300, Charcoal
- For public square details see drawing BURMAR-JHA-V6-XX-DR-A-0059

- External lighting - TBC
- External power pop up - TBC
- External uplighting - TBC

Quatlty Schedule

- Marshalls Paving or similar - 3686m2
- Contrast strip paving - 400m (linear)
- Raised low level planting 132m2
- Proposed trees - 21
- GRP Substation

BURY COUNCIL

client

BURY MARKET
MASTERPLAN

project

PROPOSED
SITE PLAN

title

BCO1

job No.

BURMAR-JHA-V6-XX-DR-A-0003 Rev P16

dwg No.

1:500 @ A1

scale

RCO

drawn



Appendix E – Flood Maps

Flood map for planning

Your reference
221-144

Location (easting/northing)
380554/410491

Created
5 Nov 2021 14:17

Your selected location is in flood zone 1, an area with a low probability of flooding.

This means:

- you don't need to do a flood risk assessment if your development is smaller than 1 hectare and not affected by other sources of flooding
- you may need to do a flood risk assessment if your development is larger than 1 hectare or affected by other sources of flooding or in an area with critical drainage problems

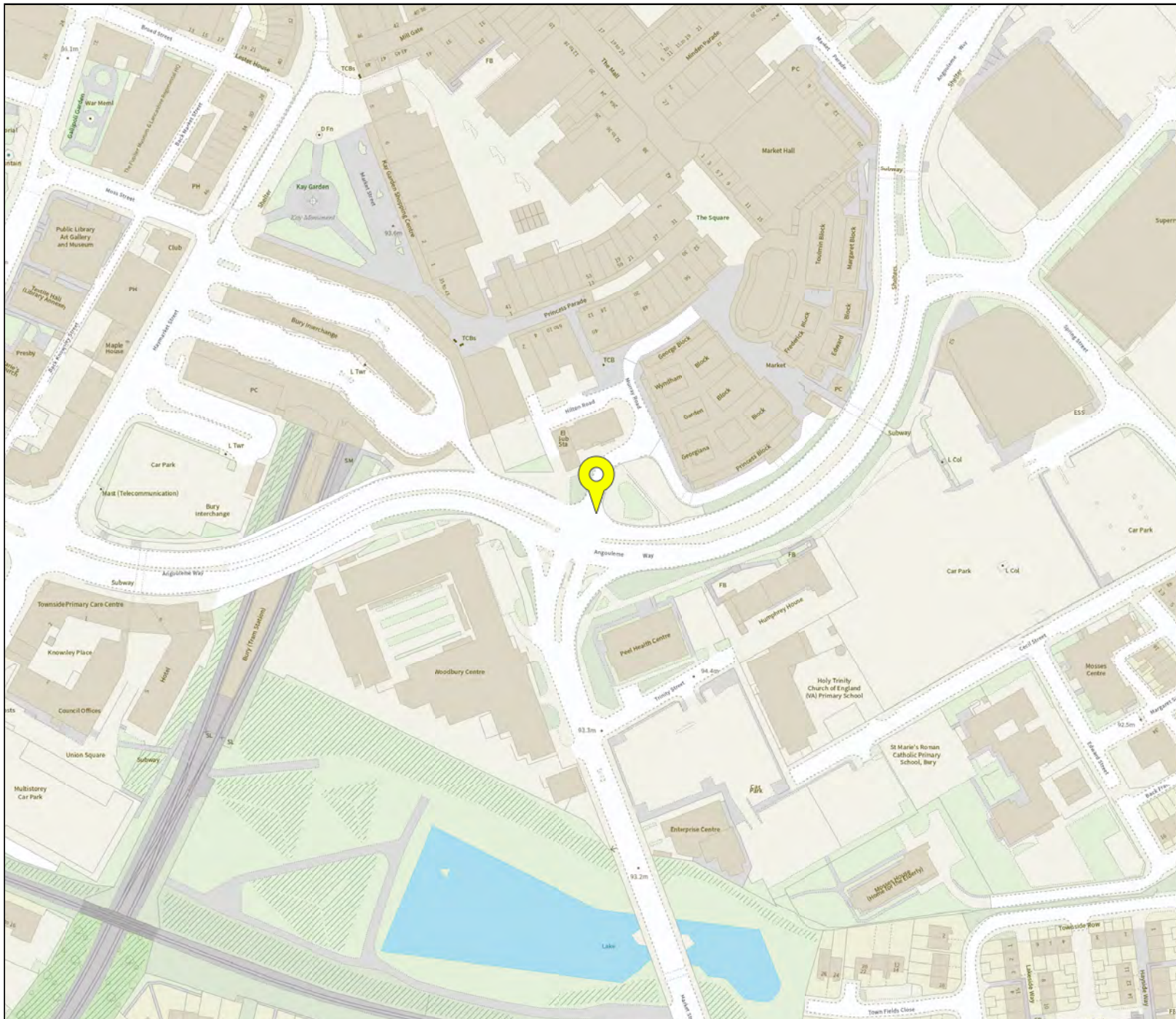
Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

Flood risk data is covered by the Open Government Licence which sets out the terms and conditions for using government data. <https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/>

Use of the address and mapping data is subject to Ordnance Survey public viewing terms under Crown copyright and database rights 2021 OS 100024198. <https://flood-map-for-planning.service.gov.uk/os-terms>



Flood map for planning

Your reference

221-144

Location (easting/northing)

380554/410491

Scale

1:2500

Created

5 Nov 2021 14:17



Selected point



Flood zone 3



Flood zone 3: areas benefitting from flood defences



Flood zone 2



Flood zone 1



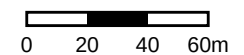
Flood defence



Main river



Flood storage area

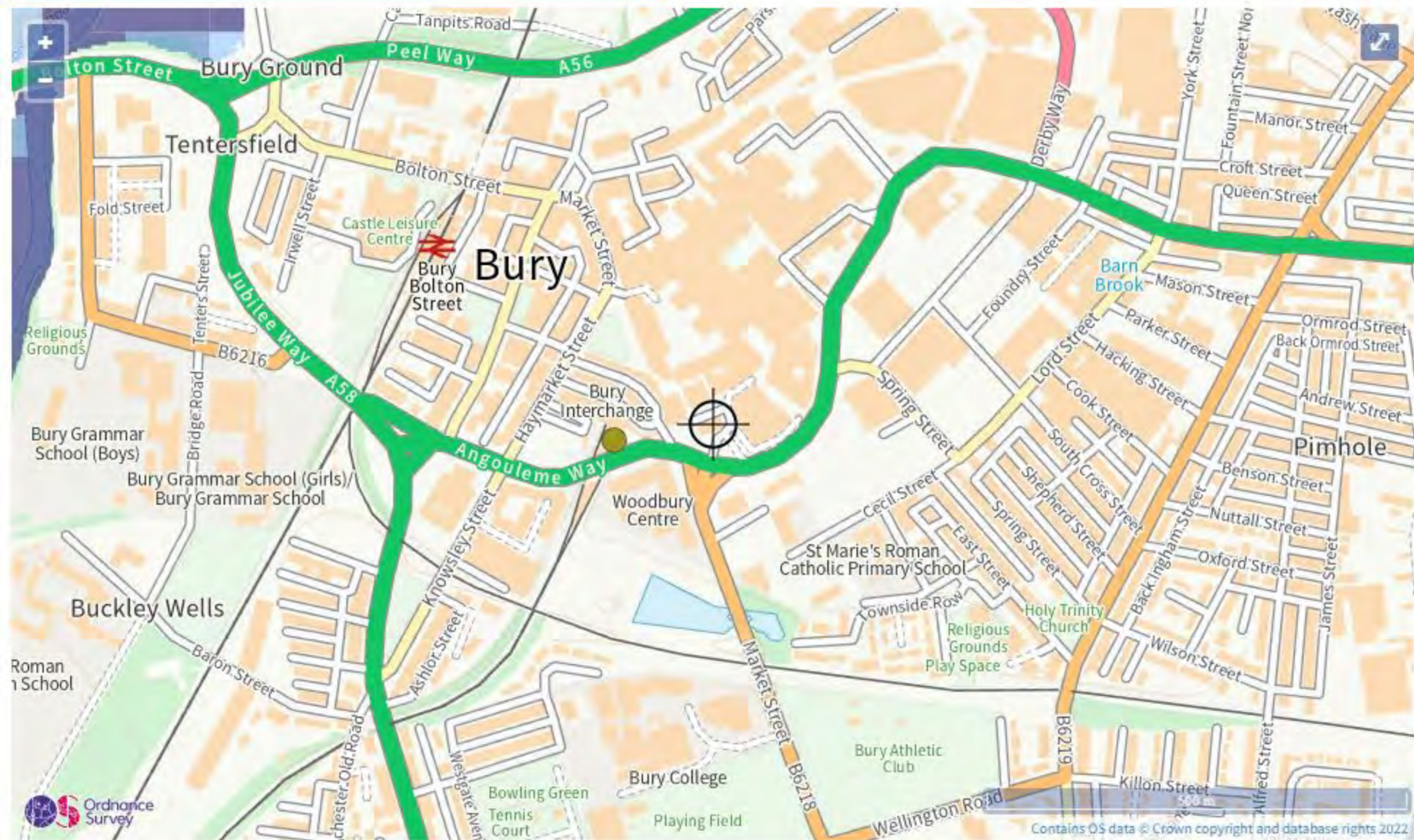


Flood risk

Location

Extent of flooding

Enter a place or postcode



Extent of flooding from rivers or the sea

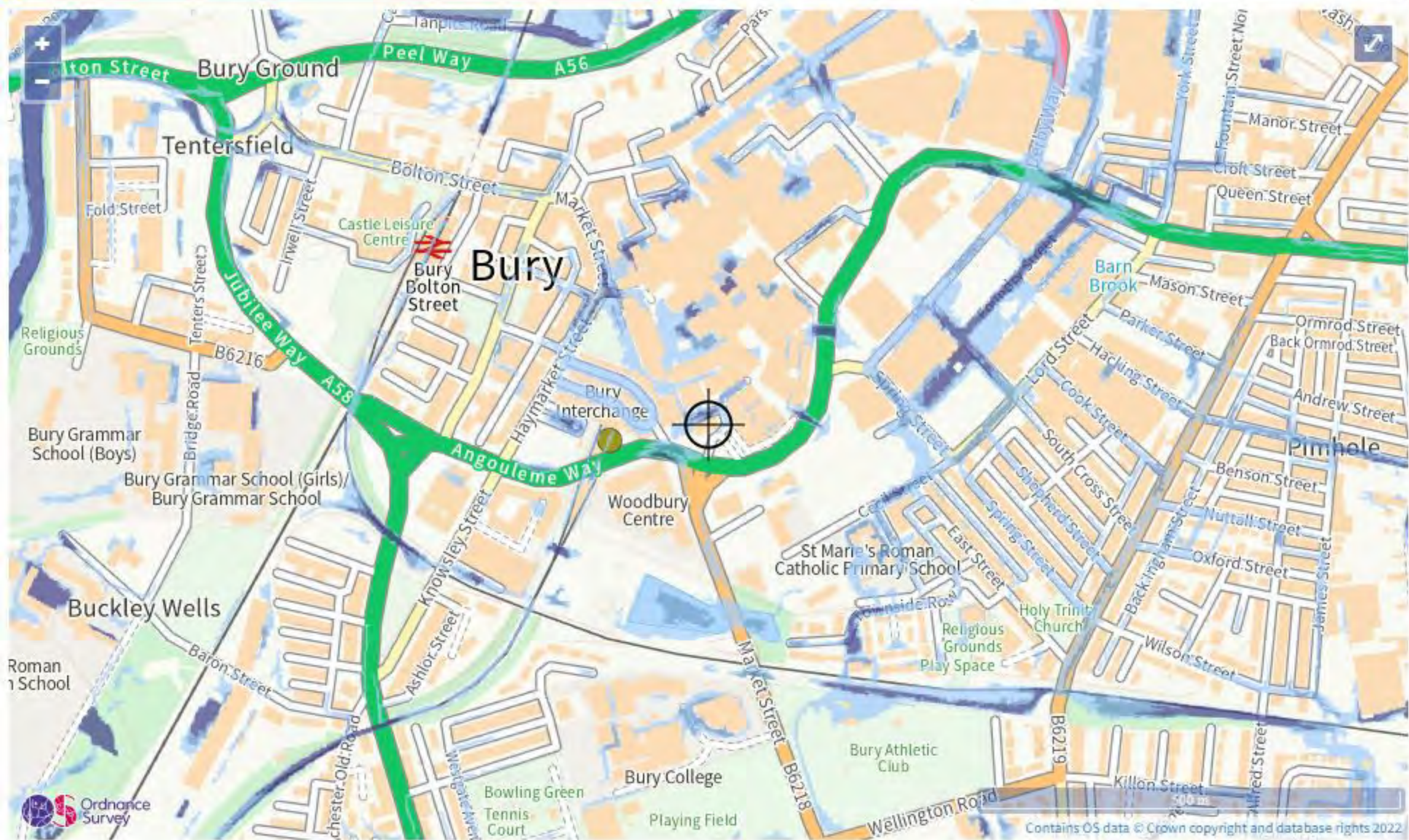
High Medium Low Very low Location you selected

Flood risk

Location

Extent of flooding

Enter a place or postcode



Extent of flooding from surface water

High Medium Low Very low Location you selected

Extent of flooding

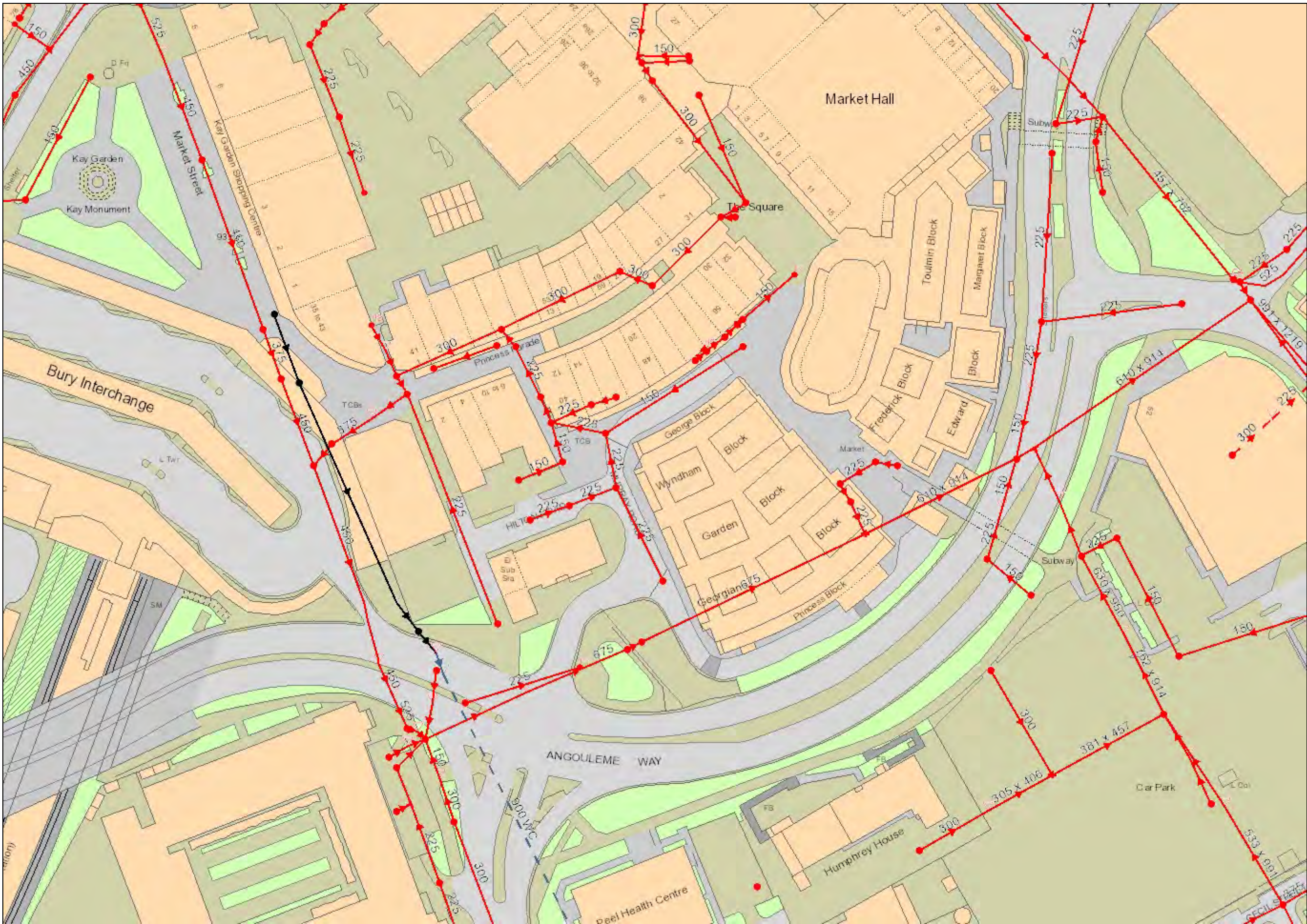
Enter a place or postcode



Maximum extent of flooding from reservoirs:

when river levels are normal when there is also flooding from rivers Location you selected

Appendix F – United Utilities Sewer Maps



United Utilities Maps for SafeDig

Date :	14/02/2022 10:54:08
Centre X:	380579
Centre Y:	410554
Scale :	1000
UserName:	4MY37

Extract from maps of United Utilities' Underground Assets

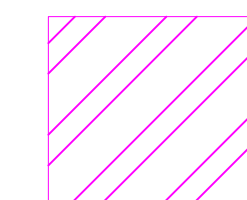
The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. The actual positions may be different from those shown on the plan and private service pipes may be shown by a blue broken line. United Utilities Water will not accept liability for any damage caused by the actual position being different from those shown.

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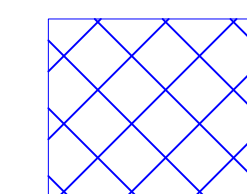


Appendix G – Pre & Post Development Impermeable Areas Drawing

PRE-DEVELOPMENT
IMPERMEABLE AREAS = 13,351m²



POST-DEVELOPMENT
IMPERMEABLE AREAS = 13,361m²



AREAS TO DRAIN AS PER
EXISTING SCENARIO = 848m²

TOTAL SITE AREA = 14876m²

[illegible]

DRAWING STATUS:

PRELIMINARY

CLIENT: _____

VINCI CONSTRUCTION

ARCHITECT:

JUST H ARCHITECTS

PROJECT: _____

BURY MARKET
MASTERPLAN

TITLE: _____

PRE AND POST DEVELOPMENT
IMPERMEABLE AREAS

STATUS:	PROJECT No.	PROJECT	ORIGINATOR	VOL/SYS	LEVEL	TYPE	ROLE	DRAWING No.	REV:
S2	221-144	BURMAR-AJP-ZZ-00-SK-C-0001							P02

SCALE @ A1:	DESIGNED:	DRAWN:	CHECKED:	APPROVED:	DATE:
N.T.S	JJR	JJR	JRS	JRS	AUG 2022

Appendix H – Brownfield Runoff Calculations

The Alan Johnston Partnership		Page 1
1 Dale Street Liverpool L2 2ET		
Date 05/08/2022 11:50	Designed by JamieRogers	
File BROWNFIELD RUN OFF RATES.MDX	Checked by	
XP Solutions	Network 2019.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.293	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	1.203	4-8	0.132

Total Area Contributing (ha) = 1.335

Total Pipe Volume (m³) = 2.209

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	10.000	0.200	50.0	0.445	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	10.000	0.200	50.0	0.445	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.002	10.000	0.200	50.0	0.445	0.00	0.0	0.600	o	375	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL E (m)	I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.09	8.000	0.445	0.0	0.0	0.0	1.85	73.7	60.3
1.001	50.00	5.16	7.725	0.890	0.0	0.0	0.0	2.23	157.5	120.5
1.002	50.00	5.23	7.450	1.335	0.0	0.0	0.0	2.57	283.6	180.8

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Network Classifications for Storm

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
1.000	1	225	1.775	1.975	Unclassified	1200	0	1.775	Unclassified
1.001	2	300	1.975	2.175	Unclassified	1200	0	1.975	Unclassified
1.002	3	375	2.175	2.375	Unclassified	1350	0	2.175	Unclassified

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
------------------------	-----------------	-----------------	-----------------	------------------------	-------------	-----------

1.002		10.000	7.250	7.400	1200	0
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Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 0 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.293		

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
 Hot Start Level (mm) 0 Inlet Coefficient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 0 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 19.000 Cv (Summer) 0.750
 Region England and Wales Ratio R 0.293 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
 Analysis Timestep Fine Inertia Status OFF
 DTS Status ON

Profile(s)

Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
 Return Period(s) (years) 1, 2, 30, 100
 Climate Change (%) 0, 0, 0, 40

									Water	Surcharged
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Level (m)	Depth (m)
1.000	1 15	Winter	1	+0%	2/15 Summer	100/15 Summer			8.163	-0.062
1.001	2 15	Winter	1	+0%	2/15 Winter	100/15 Summer			7.945	-0.080
1.002	3 15	Winter	1	+0%	30/15 Summer				7.710	-0.115

		Flooded			Pipe		
PN	US/MH Name	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)	Status	Level Exceeded
1.000	1	0.000	0.86		52.5	OK	6
1.001	2	0.000	0.87		97.5	OK	3
1.002	3	0.000	0.81		142.6	OK	

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
 Hot Start Level (mm) 0 Inlet Coefficient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 0 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 19.000 Cv (Summer) 0.750
 Region England and Wales Ratio R 0.293 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
 Analysis Timestep Fine Inertia Status OFF
 DTS Status ON

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
 Return Period(s) (years) 1, 2, 30, 100
 Climate Change (%) 0, 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	1 15	Winter	2	+0%	2/15 Summer	100/15 Summer			8.273	0.048
1.001	2 15	Winter	2	+0%	2/15 Winter	100/15 Summer			8.047	0.022
1.002	3 15	Winter	2	+0%	30/15 Summer				7.778	-0.047

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap. (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	0.000	1.06	64.8	SURCHARGED	6
1.001	2	0.000	1.08	121.3	SURCHARGED	3
1.002	3	0.000	1.00	175.0	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
 Hot Start Level (mm) 0 Inlet Coefficient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 0 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 19.000 Cv (Summer) 0.750
 Region England and Wales Ratio R 0.293 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
 Analysis Timestep Fine Inertia Status OFF
 DTS Status ON

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
 Return Period(s) (years) 1, 2, 30, 100
 Climate Change (%) 0, 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	1	15 Winter	30	+0%	2/15 Summer	100/15 Summer			9.749	1.524
1.001	2	15 Winter	30	+0%	2/15 Winter	100/15 Summer			9.111	1.086
1.002	3	15 Winter	30	+0%	30/15 Summer				8.357	0.532

PN	US/MH Name	Flooded		Pipe		Status	Level Exceeded
		Volume (m³)	Flow / Cap. (l/s)	Flow (l/s)	Overflow (l/s)		
1.000	1	0.000	1.89	116.0	FLOOD RISK	6	
1.001	2	0.000	1.95	218.4	SURCHARGED	3	
1.002	3	0.000	1.91	334.8	SURCHARGED		

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
 Hot Start Level (mm) 0 Inlet Coefficient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

 Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 0 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 19.000 Cv (Summer) 0.750
 Region England and Wales Ratio R 0.293 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
 Analysis Timestep Fine Inertia Status OFF
 DTS Status ON

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
 Return Period(s) (years) 1, 2, 30, 100
 Climate Change (%) 0, 0, 0, 40

	US/MH		Return Climate	First (X)	First (Y)	First (Z)	Overflow	Water	Surcharged
PN	Name	Storm	Period Change	Surcharge	Flood	Overflow	Act.	Level (m)	Depth (m)
1.000	1 15 Winter		100	+40%	2/15 Summer	100/15 Summer		10.049	1.824
1.001	2 15 Winter		100	+40%	2/15 Winter	100/15 Summer		10.003	1.978
1.002	3 15 Summer		100	+40%	30/15 Summer			9.140	1.315

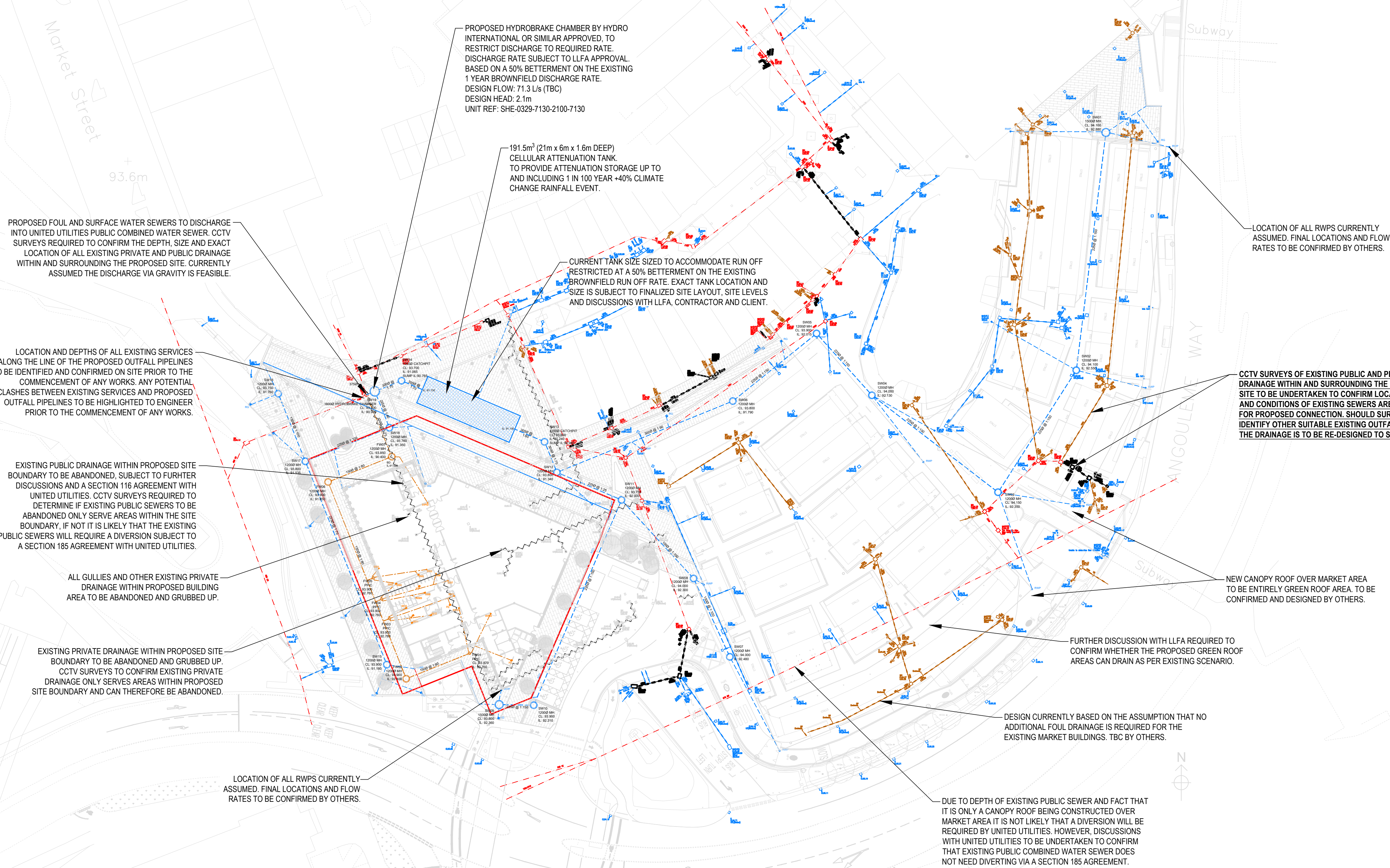
		Flooded		Pipe		
PN	US/MH Name	Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Level Exceeded
1.000	1	48.681	2.86		175.7	FLOOD 6
1.001	2	2.902	2.31		258.6	FLOOD 3
1.002	3	0.000	2.74		479.1	SURCHARGED

Appendix I – Outline Drainage Strategy Drawing & SW Calculations

PRELIMINARY SUBJECT TO CONFIRMATION OF
LANDSCAPE ARCHITECTS PROPOSED SITE LEVELS
AND ALL FOUL WATER POP UP AND RAINWATER
DOWNPIPE LOCATIONS AND FLOW RATES

PRELIMINARY SUBJECT TO CONFIRMATION OF
UNITED UTILITIES AND BURY COUNCIL
ACCEPTANCE OF DISCHARGE CONNECTION
LOCATIONS AND FLOW RATES

ALL PROPOSED DRAINAGE IS CURRENTLY
PRELIMINARY SUBJECT TO EXISTING
DRAINAGE SURVEYS AND DETAILED
DRAINAGE DESIGN BEING COMPLETED



- IMPORTANT NOTES**
- SETTING OUT SHALL BE UNDERTAKEN USING ONLY THE INFORMATION GIVEN. DISTANCES SHOULD NOT BE SCALED FROM THIS DRAWING.
 - ALL SEWERS SHALL BE CONSTRUCTED IN ACCORDANCE WITH SEWERS FOR ADOPTION 7TH EDITION AND UNITED UTILITIES DETAILS & GUIDELINES.
 - THE MINIMUM GRAVITY PIPE DIAMETER UNDER ADOPTABLE HIGHWAYS SHALL BE 150mm
 - IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY ALL INFORMATION GIVEN WITH REGARDS TO EXISTING SERVICES AND DRAINAGE CONNECTIONS ETC. PRIOR TO COMMENCING THE WORKS. THE RATES SHALL INCLUDE FOR HAND DIG AROUND SERVICES WHERE NECESSARY. THE CONTRACTOR SHALL ADHERE TO THE CDM REGULATIONS AT ALL TIMES
 - THE OUTSIDES OF ALL SEWERS SHALL BE A MINIMUM OF 1.0m FROM KERB LINES AND THE OUTSIDE OF MANHOLES SHALL BE A MINIMUM OF 0.5m FROM KERB LINES
 - EXISTING FLOWS IN WATERCOURSES, SEWERS AND LAND DRAINS SHALL BE MAINTAINED AT ALL TIMES
 - ONLY TRAINED PERSONNEL SHALL BE PERMITTED TO ENTER CONFINED SPACES
 - ALL MATERIALS TO BEAR THE RELEVANT B.S. KITEMARK AND COMPLY FULLY WITH THE SPECIFICATIONS. ALL CONCRETE & CONCRETE PRODUCTS MUST USE SULPHATE RESISTANT CEMENT (UNLESS THE SITE INVESTIGATION REPORT PROVES THAT SULPHATE ATTACK FROM SOILS AND GROUNDWATER WILL NOT OCCUR TO WITHSTAND A CLASS
 - ALL OPENING NOTICES ETC. AS REQUIRED UNDER HIGHWAYS ACTS ETC. ARE TO BE OBTAINED PRIOR TO COMMENCEMENT OF WORKS. ALL WORKS ARE TO BE INSPECTED BY L.A., NHBC OR THE NETWORK OPERATOR AS APPLICABLE.
 - WHERE "ULTRA RIB" UPVC PIPES (OR SIMILAR APPROVED) ARE USED IN ADOPTABLE DRAINAGE THEY SHALL STILL BE HANDLED AND LAID IN ACCORDANCE WITH THE SPECIFICATION AND GUIDANCE ISSUED BY THE HIGH PERFORMANCE PIPE ASSOCIATION.
 - A CLASS 3 BED AND SURROUND MUST BE USED FOR SUCH PIPES. TRENCH BACKFILL IN HIGHWAYS TO WITHIN 1M OF HIGHWAY SHALL AS DIRECTED BY THE HIGHWAY AUTHORITY BE A SUITABLE GRANULAR MATERIAL ALL IN ACCORDANCE WITH SEWERS FOR ADOPTION CL. 4.3.4.
 - SLAB LEVELS SHALL NOT BE VARIED WITHOUT REFERENCE TO THE ENGINEER FOR GUIDANCE
 - ALL GULLY CONNECTIONS TO BE 150mm VITRIFIED CLAY UNLESS NOTED OTHERWISE
 - ALL MANHOLE COVERS TO BE RECESSED TO ACCEPT FINISH AS DETAILED BY LANDSCAPE ARCHITECT
 - SLOW REST BENDS TO BE USED IN ALL LOCATIONS MADE UP FROM 2No. 45 DEG BENDS (600mm TO INVERT FROM FFL)
 - MANHOLE POSITIONS AND ACCESS COVERS TO BE ACCURATELY SET-OUT BY LANDSCAPE ARCHITECT TO SUIT EXTERNAL FINISHES
 - ALL DRAINS CAST THROUGH FOUNDATIONS TO HAVE ROCKER PIPES ON BOTH SIDES OF FOUNDATION
 - ALL POP UP POSITIONS TO BE CONFIRMED SET OUT DIMENSIONS TO BE AGREED & PROVIDED BY OTHERS
 - ALL DISCHARGE RATES TO BE CONFIRMED BY M&E DESIGNER
 - ALL SURFACE WATER COLLECTION FEATURES TO BE CONFIRMED BY THE LANDSCAPE ARCHITECT
 - STORAGE HAS BEEN PROVIDED IN A CELLULAR STORAGE TANK AND UP-SIZED MANHOLES AND PIPES.
 - EXISTING SEWER DEPTHS HAVE BEEN APPROXIMATED FROM LIMITED INFORMATION. NEW CONNECTIONS TO BE CONFIRMED PRIOR TO CONSTRUCTION OF ANY DRAINAGE WORKS.
 - LANDSCAPE ARCHITECT TO CONFIRM GULLY AND DRAINAGE CHANNEL LOCATIONS TO LANDSCAPED AREAS.
 - FOUL NETWORK TO BE CONFIRMED FOLLOWING CONFIRMATION OF BRANCH CONNECTION POINTS FROM BUILDING M&E DESIGNER
 - CCTV SURVEY OF EXISTING SITE DRAINAGE REQUIRED PRIOR TO THE COMMENCEMENT OF ANY WORKS STARTING ON SITE

LEGEND

- PROPOSED SURFACE WATER MANHOLE
- PROPOSED FOUL WATER MANHOLE
- PROPOSED SURFACE WATER PPIC
- PROPOSED FOUL WATER PPIC
- PROPOSED SURFACE WATER DRAINAGE
- PROPOSED FOUL WATER DRAINAGE
- PROPOSED BELOW GROUND CELLULAR ATTENUATION TANK
- ACO DRAIN
- ROAD GULLY
- EXISTING PRIVATE SURFACE WATER DRAINAGE
- EXISTING PRIVATE FOUL WATER DRAINAGE
- EXISTING UNITED UTILITIES COMBINED WATER SEWER
- EXISTING PRIVATE DRAINAGE TO BE ABANDONED

P02	16.09.2022	RIBA STAGE 3 (DEVELOPED DESIGN)	JJR	JRS	JRS
P01	09.08.2022	RIBA STAGE 3 DEVELOPED DESIGN	JJR	JRS	JRS
REV	DATE	DESCRIPTION	BY	CHK	APP

DRAWING STATUS:

STAGE 3

CLIENT: BURY COUNCIL

ARCHITECT: JUST H ARCHITECTS

PROJECT: BURY MARKET MASTERPLAN

TITLE: BELOW GROUND DRAINAGE OUTLINE DRAINAGE STRATEGY

STATUS:	PROJECT No.	PROJECT	ORIGINATOR	VOL/SYS/LEVEL	TYPE	ROLE	DRAWING No.	REV.
S2	221-144	BURMAR - AJP - V2 - ZZ - DR - C - 0001						P02

SCALE @ A1:	DESIGNED:	DRAWN:	CHECKED:	APPROVED:	DATE:
1:200	JJR	JJR	JRS	JRS	AUG 2022

AJP consulting engineers

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales			
Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.283	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.493	4-8	0.247	8-12	0.005

Total Area Contributing (ha) = 0.745

Total Pipe Volume (m³) = 18.908

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	50.002	0.330	151.5	0.061	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	30.255	0.200	151.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	33.210	0.220	151.0	0.082	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	17.333	0.115	150.7	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.004	22.463	0.150	149.8	0.025	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.005	39.619	0.450	88.0	0.025	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.000	18.019	0.180	100.1	0.049	5.00	0.0	0.600	o	150	Pipe/Conduit	
2.001	22.269	0.225	99.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
3.000	7.225	0.050	144.5	0.033	5.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.79	92.880	0.061	0.0	0.0	0.0	1.06	42.1	8.3
1.001	50.00	6.26	92.550	0.061	0.0	0.0	0.0	1.06	42.2	8.3
1.002	49.48	6.78	92.350	0.143	0.0	0.0	0.0	1.06	42.2	19.2
1.003	48.66	7.05	92.130	0.143	0.0	0.0	0.0	1.06	42.3	19.2
1.004	47.65	7.41	92.015	0.168	0.0	0.0	0.0	1.07	42.4	21.7
1.005	46.58	7.80	91.790	0.193	0.0	0.0	0.0	1.68	118.5	24.3
2.000	50.00	5.30	92.480	0.049	0.0	0.0	0.0	1.00	17.7	6.6
2.001	50.00	5.67	92.300	0.049	0.0	0.0	0.0	1.01	17.8	6.6
3.000	50.00	5.11	92.360	0.033	0.0	0.0	0.0	1.09	43.2	4.5

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
3.001	46.601	0.310	150.3	0.088	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.002	14.657	0.584	25.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.006	6.863	0.100	68.7	0.111	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.007	16.277	0.110	148.0	0.036	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.008	16.205	0.065	250.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.009	6.006	0.090	67.1	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
4.000	45.750	0.645	70.9	0.087	5.00	0.0	0.600	o	225	Pipe/Conduit	
5.000	15.201	0.150	101.3	0.030	5.00	0.0	0.600	o	150	Pipe/Conduit	
4.001	18.909	0.185	102.2	0.042	0.00	0.0	0.600	o	225	Pipe/Conduit	
4.002	8.179	0.200	40.9	0.076	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.010	1.883	0.019	100.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	

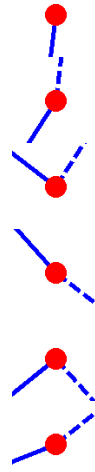
Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
3.001	50.00	5.84	92.310	0.121	0.0	0.0	0.0	1.06	42.3	16.4
2.002	50.00	5.93	92.000	0.170	0.0	0.0	0.0	2.62	104.3	23.0
1.006	46.42	7.86	91.340	0.474	0.0	0.0	0.0	1.90	134.3	59.6
1.007	45.88	8.07	91.240	0.510	0.0	0.0	0.0	1.29	91.2	63.4
1.008	45.20	8.34	91.130	0.510	0.0	0.0	0.0	0.99	70.0	63.4
1.009	45.07	8.40	91.065	0.510	0.0	0.0	0.0	1.92	135.9	63.4
4.000	50.00	5.49	91.180	0.087	0.0	0.0	0.0	1.55	61.8	11.8
5.000	50.00	5.25	91.760	0.030	0.0	0.0	0.0	1.00	17.6	4.1
4.001	50.00	5.73	91.535	0.159	0.0	0.0	0.0	1.29	51.4	21.5
4.002	50.00	5.80	91.350	0.235	0.0	0.0	0.0	2.05	81.6	31.8
1.010	45.03	8.41	90.900	0.745	0.0	0.0	0.0	1.81	200.1	90.9

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
SW01	94.100	1.220	Open Manhole	1500	1.000	92.880	225				
SW02	94.100	1.550	Open Manhole	1200	1.001	92.550	225	1.000	92.550	225	
SW03	94.150	1.800	Open Manhole	1200	1.002	92.350	225	1.001	92.350	225	
SW04	94.000	1.870	Open Manhole	1200	1.003	92.130	225	1.002	92.130	225	
SW05	93.900	1.885	Open Manhole	1200	1.004	92.015	225	1.003	92.015	225	
SW06	93.800	2.010	Open Manhole	1200	1.005	91.790	300	1.004	91.865	225	
SW07	94.000	1.520	Open Manhole	1200	2.000	92.480	150				
SW08	94.000	1.700	Open Manhole	1200	2.001	92.300	150	2.000	92.300	150	
SW09	93.800	1.440	Open Manhole	1500	3.000	92.360	225				
SW10	93.900	1.590	Open Manhole	1200	3.001	92.310	225	3.000	92.310	225	
SW11	93.750	1.750	Open Manhole	1200	2.002	92.000	225	2.001	92.075	150	
								3.001	92.000	225	
SW12	93.800	2.460	Open Manhole	1200	1.006	91.340	300	1.005	91.340	300	
								2.002	91.416	225	1
SW13	93.800	2.560	Open Manhole	1200	1.007	91.240	300	1.006	91.240	300	
Tank	93.700	2.570	Open Manhole	1200	1.008	91.130	300	1.007	91.130	300	
SW14	93.700	2.635	Open Manhole	1200	1.009	91.065	300	1.008	91.065	300	
SW15	93.900	2.720	Open Manhole	1200	4.000	91.180	225				
SW16	93.750	1.990	Open Manhole	1200	5.000	91.760	150				
SW17	93.800	3.265	Open Manhole	1200	4.001	91.535	225	4.000	90.535	225	
								5.000	91.610	150	
SW18	93.760	2.410	Open Manhole	1200	4.002	91.350	225	4.001	91.350	225	
SW19	93.700	2.800	Open Manhole	1800	1.010	90.900	375	1.009	90.975	300	
								4.002	91.150	225	100
	93.700	2.819	Open Manhole	1200		OUTFALL		1.010	90.881	375	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SW01	380665.675	410627.800	380665.675	410627.800	Required	
SW02	380659.495	410578.181	380659.495	410578.181	Required	
SW03	380643.161	410552.715	380643.161	410552.715	Required	
SW04	380616.830	410572.953	380616.830	410572.953	Required	
SW05	380605.262	410585.861	380605.262	410585.861	Required	
SW06	380587.786	410571.748	380587.786	410571.748	Required	



Manhole Schedules for Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SW07	380587.171	410518.341	380587.171	410518.341	Required	
SW08	380579.603	410534.694	380579.603	410534.694	Required	
SW09	380538.993	410508.376	380538.993	410508.376	Required	
SW10	380546.217	410508.255	380546.217	410508.255	Required	
SW11	380564.545	410551.100	380564.545	410551.100	Required	
SW12	380551.069	410556.865	380551.069	410556.865	Required	
SW13	380548.491	410563.225	380548.491	410563.225	Required	
Tank	380533.526	410569.627	380533.526	410569.627	Required	
SW14	380518.627	410576.000	380518.627	410576.000	Required	
SW15	380515.549	410516.703	380515.549	410516.703	Required	
SW16	380492.875	410573.280	380492.875	410573.280	Required	
SW17	380498.530	410559.170	380498.530	410559.170	Required	
SW18	380516.094	410566.174	380516.094	410566.174	Required	
SW19	380513.052	410573.766	380513.052	410573.766	Required	
	380511.301	410573.072			No Entry	

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	225	SW01	94.100	92.880	0.995	Open Manhole	1500
1.001	o	225	SW02	94.100	92.550	1.325	Open Manhole	1200
1.002	o	225	SW03	94.150	92.350	1.575	Open Manhole	1200
1.003	o	225	SW04	94.000	92.130	1.645	Open Manhole	1200
1.004	o	225	SW05	93.900	92.015	1.660	Open Manhole	1200
1.005	o	300	SW06	93.800	91.790	1.710	Open Manhole	1200
2.000	o	150	SW07	94.000	92.480	1.370	Open Manhole	1200
2.001	o	150	SW08	94.000	92.300	1.550	Open Manhole	1200
3.000	o	225	SW09	93.800	92.360	1.215	Open Manhole	1500
3.001	o	225	SW10	93.900	92.310	1.365	Open Manhole	1200
2.002	o	225	SW11	93.750	92.000	1.525	Open Manhole	1200
1.006	o	300	SW12	93.800	91.340	2.160	Open Manhole	1200
1.007	o	300	SW13	93.800	91.240	2.260	Open Manhole	1200
1.008	o	300	Tank	93.700	91.130	2.270	Open Manhole	1200
1.009	o	300	SW14	93.700	91.065	2.335	Open Manhole	1200
4.000	o	225	SW15	93.900	91.180	2.495	Open Manhole	1200
5.000	o	150	SW16	93.750	91.760	1.840	Open Manhole	1200
4.001	o	225	SW17	93.800	91.535	2.040	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	50.002	151.5	SW02	94.100	92.550	1.325	Open Manhole	1200
1.001	30.255	151.3	SW03	94.150	92.350	1.575	Open Manhole	1200
1.002	33.210	151.0	SW04	94.000	92.130	1.645	Open Manhole	1200
1.003	17.333	150.7	SW05	93.900	92.015	1.660	Open Manhole	1200
1.004	22.463	149.8	SW06	93.800	91.865	1.710	Open Manhole	1200
1.005	39.619	88.0	SW12	93.800	91.340	2.160	Open Manhole	1200
2.000	18.019	100.1	SW08	94.000	92.300	1.550	Open Manhole	1200
2.001	22.269	99.0	SW11	93.750	92.075	1.525	Open Manhole	1200
3.000	7.225	144.5	SW10	93.900	92.310	1.365	Open Manhole	1200
3.001	46.601	150.3	SW11	93.750	92.000	1.525	Open Manhole	1200
2.002	14.657	25.1	SW12	93.800	91.416	2.159	Open Manhole	1200
1.006	6.863	68.7	SW13	93.800	91.240	2.260	Open Manhole	1200
1.007	16.277	148.0	Tank	93.700	91.130	2.270	Open Manhole	1200
1.008	16.205	250.0	SW14	93.700	91.065	2.335	Open Manhole	1200
1.009	6.006	67.1	SW19	93.700	90.975	2.425	Open Manhole	1800
4.000	45.750	70.9	SW17	93.800	90.535	3.040	Open Manhole	1200
5.000	15.201	101.3	SW17	93.800	91.610	2.040	Open Manhole	1200
4.001	18.909	102.2	SW18	93.760	91.350	2.185	Open Manhole	1200

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
4.002	o	225	SW18	93.760	91.350	2.185	Open Manhole	1200
1.010	o	375	SW19	93.700	90.900	2.425	Open Manhole	1800

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
4.002	8.179	40.9	SW19	93.700	91.150	2.325	Open Manhole	1800
1.010	1.883	100.0		93.700	90.881	2.444	Open Manhole	1200

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.061	0.061	0.061
1.001	-	-	100	0.000	0.000	0.000
1.002	-	-	100	0.082	0.082	0.082
1.003	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.025	0.025	0.025
1.005	-	-	100	0.025	0.025	0.025
2.000	-	-	100	0.049	0.049	0.049
2.001	-	-	100	0.000	0.000	0.000
3.000	-	-	100	0.033	0.033	0.033
3.001	-	-	100	0.088	0.088	0.088
2.002	-	-	100	0.000	0.000	0.000
1.006	-	-	100	0.111	0.111	0.111
1.007	-	-	100	0.036	0.036	0.036
1.008	-	-	100	0.000	0.000	0.000
1.009	-	-	100	0.000	0.000	0.000
4.000	-	-	100	0.087	0.087	0.087
5.000	-	-	100	0.030	0.030	0.030
4.001	-	-	100	0.042	0.042	0.042
4.002	-	-	100	0.076	0.076	0.076
1.010	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.745	0.745	0.745

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D, L (mm)	W (mm)
1.010		93.700	90.881	89.960	1200	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 8
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.283		

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Storage Structures for Storm

Cellular Storage Manhole: Tank, DS/PN: 1.008

Invert Level (m) 91.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	126.0	0.0	1.600	126.0	0.0	1.601	0.0	0.0

Time Area Diagram for Green Roof at Pipe Number 1.000 (Storm)

Area (m³) 803 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)
0	4	0.014592	32	36	0.002946	64	68	0.000595	96	100	0.000120
4	8	0.011947	36	40	0.002412	68	72	0.000487	100	104	0.000098
8	12	0.009781	40	44	0.001975	72	76	0.000399	104	108	0.000080
12	16	0.008008	44	48	0.001617	76	80	0.000326	108	112	0.000066
16	20	0.006557	48	52	0.001324	80	84	0.000267	112	116	0.000054
20	24	0.005368	52	56	0.001084	84	88	0.000219	116	120	0.000044
24	28	0.004395	56	60	0.000887	88	92	0.000179			
28	32	0.003598	60	64	0.000726	92	96	0.000147			

Time Area Diagram for Green Roof at Pipe Number 1.001 (Storm)

Area (m³) 972 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)
0	4	0.017663	32	36	0.003566	64	68	0.000720	96	100	0.000145
4	8	0.014461	36	40	0.002920	68	72	0.000589	100	104	0.000119
8	12	0.011840	40	44	0.002390	72	76	0.000483	104	108	0.000097
12	16	0.009694	44	48	0.001957	76	80	0.000395	108	112	0.000080
16	20	0.007937	48	52	0.001602	80	84	0.000324	112	116	0.000065
20	24	0.006498	52	56	0.001312	84	88	0.000265	116	120	0.000053
24	28	0.005320	56	60	0.001074	88	92	0.000217			
28	32	0.004356	60	64	0.000879	92	96	0.000178			

Time Area Diagram for Green Roof at Pipe Number 1.002 (Storm)

Area (m³) 1128 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)
0	4	0.020498	28	32	0.005055	56	60	0.001246	84	88	0.000307
4	8	0.016782	32	36	0.004138	60	64	0.001021	88	92	0.000252
8	12	0.013740	36	40	0.003388	64	68	0.000836	92	96	0.000206
12	16	0.011250	40	44	0.002774	68	72	0.000684	96	100	0.000169
16	20	0.009210	44	48	0.002271	72	76	0.000560	100	104	0.000138
20	24	0.007541	48	52	0.001860	76	80	0.000459	104	108	0.000113
24	28	0.006174	52	56	0.001522	80	84	0.000375	108	112	0.000093

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Time Area Diagram for Green Roof at Pipe Number 1.002 (Storm)

Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)
112	116	0.000076	116	120	0.000062						

Time Area Diagram for Green Roof at Pipe Number 1.003 (Storm)

Area (m³) 1002 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)
0	4	0.018208	32	36	0.003676	64	68	0.000742	96	100	0.000150
4	8	0.014908	36	40	0.003010	68	72	0.000608	100	104	0.000123
8	12	0.012205	40	44	0.002464	72	76	0.000498	104	108	0.000100
12	16	0.009993	44	48	0.002018	76	80	0.000407	108	112	0.000082
16	20	0.008182	48	52	0.001652	80	84	0.000333	112	116	0.000067
20	24	0.006698	52	56	0.001352	84	88	0.000273	116	120	0.000055
24	28	0.005484	56	60	0.001107	88	92	0.000224			
28	32	0.004490	60	64	0.000907	92	96	0.000183			

Time Area Diagram for Green Roof at Pipe Number 1.004 (Storm)

Area (m³) 419 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)
0	4	0.007614	32	36	0.001537	64	68	0.000310	96	100	0.000063
4	8	0.006234	36	40	0.001259	68	72	0.000254	100	104	0.000051
8	12	0.005104	40	44	0.001030	72	76	0.000208	104	108	0.000042
12	16	0.004179	44	48	0.000844	76	80	0.000170	108	112	0.000034
16	20	0.003421	48	52	0.000691	80	84	0.000139	112	116	0.000028
20	24	0.002801	52	56	0.000566	84	88	0.000114	116	120	0.000023
24	28	0.002293	56	60	0.000463	88	92	0.000093			
28	32	0.001878	60	64	0.000379	92	96	0.000077			

Time Area Diagram for Green Roof at Pipe Number 1.005 (Storm)

Area (m³) 413 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)
0	4	0.007505	32	36	0.001515	64	68	0.000306	96	100	0.000062
4	8	0.006145	36	40	0.001241	68	72	0.000250	100	104	0.000051
8	12	0.005031	40	44	0.001016	72	76	0.000205	104	108	0.000041
12	16	0.004119	44	48	0.000832	76	80	0.000168	108	112	0.000034
16	20	0.003372	48	52	0.000681	80	84	0.000137	112	116	0.000028
20	24	0.002761	52	56	0.000557	84	88	0.000113	116	120	0.000023
24	28	0.002260	56	60	0.000456	88	92	0.000092			
28	32	0.001851	60	64	0.000374	92	96	0.000075			

Time Area Diagram for Green Roof at Pipe Number 2.000 (Storm)

Area (m³) 767 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)
0	4	0.013938	32	36	0.002814	64	68	0.000568	96	100	0.000115
4	8	0.011411	36	40	0.002304	68	72	0.000465	100	104	0.000094
8	12	0.009343	40	44	0.001886	72	76	0.000381	104	108	0.000077
12	16	0.007649	44	48	0.001544	76	80	0.000312	108	112	0.000063
16	20	0.006263	48	52	0.001264	80	84	0.000255	112	116	0.000052
20	24	0.005127	52	56	0.001035	84	88	0.000209	116	120	0.000042
24	28	0.004198	56	60	0.000848	88	92	0.000171			
28	32	0.003437	60	64	0.000694	92	96	0.000140			

Time Area Diagram for Green Roof at Pipe Number 2.001 (Storm)

Area (m³) 678 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)
0	4	0.012321	32	36	0.002487	64	68	0.000502	96	100	0.000101
4	8	0.010087	36	40	0.002037	68	72	0.000411	100	104	0.000083
8	12	0.008259	40	44	0.001667	72	76	0.000337	104	108	0.000068
12	16	0.006762	44	48	0.001365	76	80	0.000276	108	112	0.000056
16	20	0.005536	48	52	0.001118	80	84	0.000226	112	116	0.000046
20	24	0.004532	52	56	0.000915	84	88	0.000185	116	120	0.000037
24	28	0.003711	56	60	0.000749	88	92	0.000151			
28	32	0.003038	60	64	0.000613	92	96	0.000124			

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
 Hot Start Level (mm) 0 Inlet Coefficient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 8
 Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 19.000 Cv (Summer) 0.750
 Region England and Wales Ratio R 0.283 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status ON
 DVD Status ON
 Inertia Status OFF

Profile(s)

Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
 Return Period(s) (years) 1, 2, 30, 100
 Climate Change (%) 0, 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m ³)
1.000	SW01	120 Winter	1	+0%	100/30 Winter				92.918	-0.187	0.000
1.001	SW02	120 Winter	1	+0%	100/30 Summer				92.608	-0.167	0.000
1.002	SW03	120 Winter	1	+0%	100/15 Winter				92.425	-0.150	0.000
1.003	SW04	120 Winter	1	+0%	100/15 Summer				92.221	-0.134	0.000
1.004	SW05	120 Winter	1	+0%	100/15 Summer				92.110	-0.130	0.000
1.005	SW06	120 Winter	1	+0%	100/30 Summer				91.865	-0.225	0.000
2.000	SW07	120 Winter	1	+0%	100/30 Summer				92.519	-0.111	0.000
2.001	SW08	120 Winter	1	+0%	100/15 Summer				92.355	-0.095	0.000
3.000	SW09	15 Winter	1	+0%	100/15 Summer				92.416	-0.169	0.000
3.001	SW10	15 Winter	1	+0%	100/15 Summer				92.397	-0.138	0.000
2.002	SW11	15 Winter	1	+0%	100/30 Summer				92.055	-0.170	0.000
1.006	SW12	120 Winter	1	+0%	30/60 Winter				91.464	-0.176	0.000
1.007	SW13	120 Winter	1	+0%	30/60 Winter				91.369	-0.171	0.000
1.008	Tank	120 Winter	1	+0%	30/60 Winter				91.260	-0.170	0.000
1.009	SW14	120 Winter	1	+0%	30/60 Winter				91.179	-0.186	0.000
4.000	SW15	15 Winter	1	+0%	1/15 Summer				91.656	0.251	0.000
5.000	SW16	15 Winter	1	+0%	100/15 Summer				91.807	-0.103	0.000
4.001	SW17	15 Winter	1	+0%	100/15 Summer				91.626	-0.134	0.000
4.002	SW18	15 Winter	1	+0%	100/15 Summer				91.444	-0.131	0.000
1.010	SW19	240 Winter	1	+0%	30/60 Winter				91.099	-0.176	0.000

PN	US/MH Name	Flow / Cap. (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SW01	0.07	2.7	OK	
1.001	SW02	0.15	6.0	OK	
1.002	SW03	0.25	9.8	OK	
1.003	SW04	0.35	13.1	OK	
1.004	SW05	0.37	14.5	OK	

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.005	SW06	0.14		15.9	OK	
2.000	SW07	0.16		2.6	OK	
2.001	SW08	0.29		4.9	OK	
3.000	SW09	0.12		3.8	OK	
3.001	SW10	0.31		12.4	OK	
2.002	SW11	0.13		12.3	OK	
1.006	SW12	0.36		28.6	OK	
1.007	SW13	0.38		29.8	OK	
1.008	Tank	0.39		23.2	OK	
1.009	SW14	0.31		23.2	OK	
4.000	SW15	0.15		8.6	SURCHARGED	
5.000	SW16	0.21		3.5	OK	
4.001	SW17	0.34		15.6	OK	
4.002	SW18	0.36		22.4	OK	
1.010	SW19	0.33		28.6	OK	

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
 Hot Start Level (mm) 0 Inlet Coefficient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 8
 Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 19.000 Cv (Summer) 0.750
 Region England and Wales Ratio R 0.283 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status ON
 DVD Status ON
 Inertia Status OFF

Profile(s)

Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
 Return Period(s) (years) 1, 2, 30, 100
 Climate Change (%) 0, 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m ³)
1.000	SW01	60 Winter	2	+0%	100/30 Winter				92.926	-0.179	0.000
1.001	SW02	60 Winter	2	+0%	100/30 Summer				92.618	-0.157	0.000
1.002	SW03	60 Winter	2	+0%	100/15 Winter				92.438	-0.137	0.000
1.003	SW04	60 Winter	2	+0%	100/15 Summer				92.236	-0.119	0.000
1.004	SW05	60 Winter	2	+0%	100/15 Summer				92.126	-0.114	0.000
1.005	SW06	60 Winter	2	+0%	100/30 Summer				91.878	-0.212	0.000
2.000	SW07	60 Winter	2	+0%	100/30 Summer				92.527	-0.103	0.000
2.001	SW08	60 Winter	2	+0%	100/15 Summer				92.366	-0.084	0.000
3.000	SW09	15 Winter	2	+0%	100/15 Summer				92.427	-0.158	0.000
3.001	SW10	15 Winter	2	+0%	100/15 Summer				92.410	-0.125	0.000
2.002	SW11	120 Winter	2	+0%	100/30 Summer				92.063	-0.162	0.000
1.006	SW12	120 Winter	2	+0%	30/60 Winter				91.485	-0.155	0.000
1.007	SW13	120 Winter	2	+0%	30/60 Winter				91.391	-0.149	0.000
1.008	Tank	120 Winter	2	+0%	30/60 Winter				91.290	-0.140	0.000
1.009	SW14	120 Winter	2	+0%	30/60 Winter				91.204	-0.161	0.000
4.000	SW15	15 Winter	2	+0%	1/15 Summer				91.683	0.278	0.000
5.000	SW16	15 Winter	2	+0%	100/15 Summer				91.814	-0.096	0.000
4.001	SW17	15 Winter	2	+0%	100/15 Summer				91.645	-0.115	0.000
4.002	SW18	15 Winter	2	+0%	100/15 Summer				91.463	-0.112	0.000
1.010	SW19	120 Winter	2	+0%	30/60 Winter				91.144	-0.131	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SW01	0.09		3.6	OK	
1.001	SW02	0.20		7.9	OK	
1.002	SW03	0.32		12.9	OK	
1.003	SW04	0.45		17.2	OK	
1.004	SW05	0.49		19.0	OK	

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.005	SW06	0.19		20.7	OK	
2.000	SW07	0.21		3.6	OK	
2.001	SW08	0.40		6.7	OK	
3.000	SW09	0.16		4.9	OK	
3.001	SW10	0.40		16.0	OK	
2.002	SW11	0.17		15.9	OK	
1.006	SW12	0.47		37.5	OK	
1.007	SW13	0.51		39.3	OK	
1.008	Tank	0.56		33.0	OK	
1.009	SW14	0.44		33.0	OK	
4.000	SW15	0.21		12.3	SURCHARGED	
5.000	SW16	0.28		4.5	OK	
4.001	SW17	0.46		21.4	OK	
4.002	SW18	0.49		30.7	OK	
1.010	SW19	0.46		40.2	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
 Hot Start Level (mm) 0 Inlet Coefficient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 8
 Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 19.000 Cv (Summer) 0.750
 Region England and Wales Ratio R 0.283 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status ON
 DVD Status ON
 Inertia Status OFF

Profile(s)

Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
 Return Period(s) (years) 1, 2, 30, 100
 Climate Change (%) 0, 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m ³)
1.000	SW01	60 Winter	30	+0%	100/30 Winter				92.945	-0.160	0.000
1.001	SW02	60 Winter	30	+0%	100/30 Summer				92.651	-0.124	0.000
1.002	SW03	60 Winter	30	+0%	100/15 Winter				92.486	-0.089	0.000
1.003	SW04	60 Winter	30	+0%	100/15 Summer				92.325	-0.030	0.000
1.004	SW05	60 Winter	30	+0%	100/15 Summer				92.225	-0.015	0.000
1.005	SW06	60 Winter	30	+0%	100/30 Summer				91.919	-0.171	0.000
2.000	SW07	60 Winter	30	+0%	100/30 Summer				92.549	-0.081	0.000
2.001	SW08	60 Winter	30	+0%	100/15 Summer				92.402	-0.048	0.000
3.000	SW09	15 Winter	30	+0%	100/15 Summer				92.487	-0.098	0.000
3.001	SW10	15 Winter	30	+0%	100/15 Summer				92.477	-0.058	0.000
2.002	SW11	120 Winter	30	+0%	100/30 Summer				92.097	-0.128	0.000
1.006	SW12	120 Winter	30	+0%	30/60 Winter				91.748	0.108	0.000
1.007	SW13	120 Winter	30	+0%	30/60 Winter				91.641	0.101	0.000
1.008	Tank	120 Winter	30	+0%	30/60 Winter				91.537	0.107	0.000
1.009	SW14	120 Winter	30	+0%	30/60 Winter				91.464	0.099	0.000
4.000	SW15	15 Winter	30	+0%	1/15 Summer				91.844	0.439	0.000
5.000	SW16	15 Winter	30	+0%	100/15 Summer				91.838	-0.072	0.000
4.001	SW17	15 Winter	30	+0%	100/15 Summer				91.740	-0.020	0.000
4.002	SW18	15 Winter	30	+0%	100/15 Summer				91.575	0.000	0.000
1.010	SW19	120 Winter	30	+0%	30/60 Winter				91.362	0.087	0.000

PN	US/MH Name	Flow / Cap. (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SW01	0.18	7.5	OK	
1.001	SW02	0.42	16.5	OK	
1.002	SW03	0.68	26.9	OK	
1.003	SW04	0.94	35.5	OK	
1.004	SW05	1.00	38.8	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.005	SW06	0.39		42.6	OK	
2.000	SW07	0.43		7.1	OK	
2.001	SW08	0.80		13.4	OK	
3.000	SW09	0.31		9.7	OK	
3.001	SW10	0.86		34.9	OK	
2.002	SW11	0.38		35.1	OK	
1.006	SW12	0.87		69.2	SURCHARGED	
1.007	SW13	0.93		72.3	SURCHARGED	
1.008	Tank	0.99		58.8	SURCHARGED	
1.009	SW14	0.79		59.1	SURCHARGED	
4.000	SW15	0.40		23.9	SURCHARGED	
5.000	SW16	0.52		8.5	OK	
4.001	SW17	0.94		43.6	OK	
4.002	SW18	1.01		63.6	OK	
1.010	SW19	0.79		69.2	SURCHARGED	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
 Hot Start Level (mm) 0 Inlet Coefficient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 8
 Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 19.000 Cv (Summer) 0.750
 Region England and Wales Ratio R 0.283 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status ON
 DVD Status ON
 Inertia Status OFF

Profile(s)

Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
 Return Period(s) (years) 1, 2, 30, 100
 Climate Change (%) 0, 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m ³)
1.000	SW01	60 Winter	100	+40%	100/30 Winter				93.750	0.645	0.000
1.001	SW02	60 Winter	100	+40%	100/30 Summer				93.714	0.939	0.000
1.002	SW03	120 Winter	100	+40%	100/15 Winter				93.646	1.071	0.000
1.003	SW04	120 Winter	100	+40%	100/15 Summer				93.556	1.201	0.000
1.004	SW05	120 Winter	100	+40%	100/15 Summer				93.464	1.224	0.000
1.005	SW06	120 Winter	100	+40%	100/30 Summer				93.326	1.236	0.000
2.000	SW07	120 Winter	100	+40%	100/30 Summer				93.346	0.716	0.000
2.001	SW08	120 Winter	100	+40%	100/15 Summer				93.318	0.868	0.000
3.000	SW09	120 Winter	100	+40%	100/15 Summer				93.226	0.641	0.000
3.001	SW10	120 Winter	100	+40%	100/15 Summer				93.224	0.689	0.000
2.002	SW11	120 Winter	100	+40%	100/30 Summer				93.211	0.986	0.000
1.006	SW12	120 Winter	100	+40%	30/60 Winter				93.183	1.543	0.000
1.007	SW13	120 Winter	100	+40%	30/60 Winter				93.075	1.535	0.000
1.008	Tank	120 Winter	100	+40%	30/60 Winter				92.970	1.540	0.000
1.009	SW14	120 Winter	100	+40%	30/60 Winter				92.889	1.524	0.000
4.000	SW15	120 Winter	100	+40%	1/15 Summer				92.818	1.413	0.000
5.000	SW16	120 Winter	100	+40%	100/15 Summer				92.812	0.902	0.000
4.001	SW17	120 Winter	100	+40%	100/15 Summer				92.808	1.048	0.000
4.002	SW18	120 Winter	100	+40%	100/15 Summer				92.796	1.221	0.000
1.010	SW19	120 Winter	100	+40%	30/60 Winter				92.787	1.512	0.000

		Pipe		Level	
PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Flow (l/s)	Status
1.000	SW01	0.31		12.6	SURCHARGED
1.001	SW02	0.63		24.9	SURCHARGED
1.002	SW03	0.92		36.6	SURCHARGED
1.003	SW04	1.31		49.5	SURCHARGED
1.004	SW05	1.41		54.6	SURCHARGED

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.005	SW06	0.54		59.7	SURCHARGED	
2.000	SW07	0.61		10.1	SURCHARGED	
2.001	SW08	1.12		18.8	SURCHARGED	
3.000	SW09	0.21		6.7	SURCHARGED	
3.001	SW10	0.60		24.4	SURCHARGED	
2.002	SW11	0.44		40.0	SURCHARGED	
1.006	SW12	1.34		106.3	SURCHARGED	
1.007	SW13	1.44		111.1	SURCHARGED	
1.008	Tank	1.17		69.1	SURCHARGED	
1.009	SW14	0.91		67.9	SURCHARGED	
4.000	SW15	0.28		16.6	SURCHARGED	
5.000	SW16	0.37		6.0	SURCHARGED	
4.001	SW17	0.66		30.4	SURCHARGED	
4.002	SW18	0.68		42.6	SURCHARGED	
1.010	SW19	0.81		71.2	SURCHARGED	